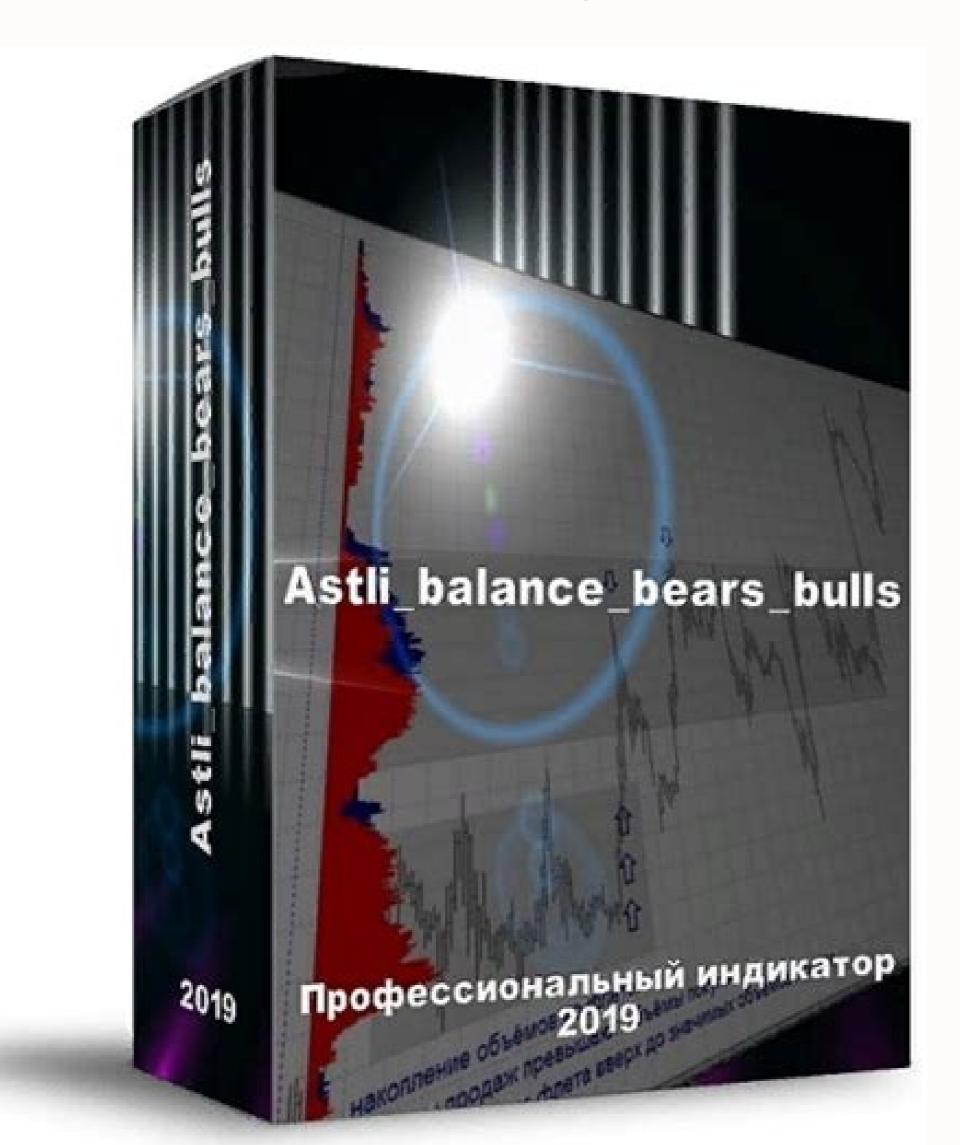
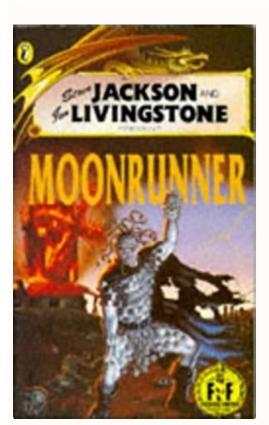
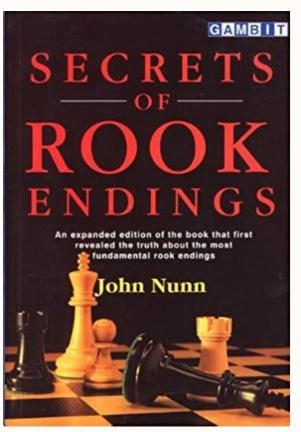
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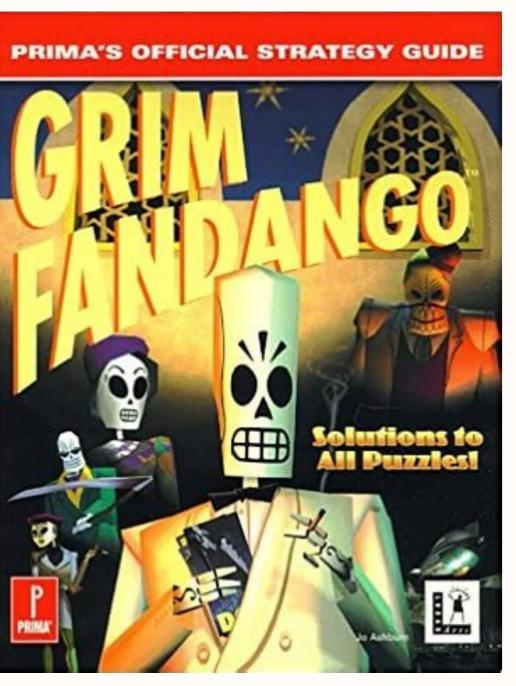
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12345 d. SR 3.3 What is an alias? Then we examine how polymorphic references can be accomplished using either inheritance or interfaces. Note that the word Liftoff is printed on the same line as the first few words, even though it is printed using the println method. on one line b. Note, however, that the cast does not change the value in money. There are times when you may want to treat primitive data as though they were objects. The following is an example of an if-else statement: if (height STANDARD) * (RATE * 1.5); else pay = hours * RATE; NumberFormat fmt = NumberFormat.getCurrencyInstance(); System.out.println("Gross earnings: to read a string from the user. as follows: num 42 name "James Gosling" Because an object reference variable holds the address of the object, it can be thought of as a pointer to the location in memory where the object is held. A variable declaration can have multiple variables of the same type declared on one line. Statements that control the flow of execution through a method fall into two categories: conditionals and loops. Primitive Type Wrapper Class byte Byte short Short int Integer long Long float Float double Double char Character boolean Boolean void Void F IGU RE 3.7 Wrapper classes in the java.lang package 3. 4 Expressions count currently contains the value 15, then the following statement assigns the value 15 to total and the value 16 to count: total = count++; However, if count contains 15, the following statement assigns the value used in the larger expression depends on whether a prefix form or a postfix form of the increment operator is used. We would set up a loop that repeats the calculation for each student until there are no more students to process. It makes it easier for instructors to point out limitations of the API implementations in a compare-and-contrast fashion. Here is an example: NumberFormat fmt = NumberFormat.getPercentageInstance(); System.out.println(fmt.format(value)); SRA 3.18 The following is a declaration of an enumerated type for movie ratings. The Scanner class is revisited for iterative input parsing and reading text files. If a constant is used throughout a program and its value has to be modified, then you need change it in only one place. The operators and operands used to manner in which expressions are evaluated and used is fundamental perform a calculation. Trying to combine incompatible types will generate an error when you K EY C ONC EPT attempt to compile the program. Figure 2.7 lists some of the methods provided by the Scanner class. As you can imagine, it is not a good idea and lowercase versions of a letter are to use multiple identifiers that differ only in their case, because they distinct. To instantiate an object, we can use the new operator, which returns the address of the new object. To instantiate an object, we can use the new object. to make it clear how the expression is evaluated. logical error An error in a program that causes it to produce incorrect results. The program in Listing 2.7, called TempConverter, converts a particular Celsius temperature value to its equivalent Fahrenheit value using an expression that computes the formula Fahrenheit = L I STING 9 Celsius + 32 object. 🔳 We cannot assign a value of one type to a variable of an incompatible type. An object is said to be an instance of a particular class. How is it related to garbage collection? When converting from an int or a long to a double, some of the least significant digits may be lost. 39 40 C H APTE R 2 Data and Expressions Escape Sequence Meaning \b backspace \t tab new line \r carriage return \" double quote \ backslash F I G UR E 2.1 Java escape Sequences Because the double quotation character(") is used in the Java language to indicate the beginning and end of a string, we must use a special technique to print the quotation character. Examples: represents the newline character, and \"represents the tab character, and \"represents the quotation characters 'a' through 'z' are continuous and in order, as are the uppercase alphabetic characters 'A' through 'Z'. 5 A house blueprint and three houses created from it 23 24 C H APTE R 1 Introduction made to the state of the object should be accomplished by that object's methods. System.out.println("50 plus 25 is " + 50 + 25); EX 2.5 What output is produced by the following statement? The words true and false are reserved in Java as boolean literals and cannot be used outside of this context. SR 2.5 What is an escape sequence? They are called widening conversions because they go from one data type to another type that uses an equal or greater amount of space to store the value. In this example, the returned value is assigned to VideoNote Creating objects 77 78 C H APTE R 3 Using Classes and Objects the variable count. The characters and symbols from many languages are included in the Unicode definition. Figure 3.4 lists several of its methods, result = (14 + 8) / 2; Any expression in parentheses is evaluated first. The earlier we consider alternatives, the easier it is to modify our approach. String to Upper Case () Returns a new string identical to this string except all lowercase letters are converted to their uppercase equivalent. pseudorandom number generator A program element that performs calculations to produce a series of numbers in seemingly random order. boolean equalsIgnoreCase (String str) Returns true if this string contains the same characters as str (without regard to case) and false otherwise. They are part of the Java standard library of predefined code, a set of classes and methods that someone has already written for us. PP 3.4 Write an application that reads the (x, y) coordinates for two points. 3 Packages Then the toUpperCase method is executed on the mutation1 object, and the resulting string is stored in mutation2: mutation 2 "CHANGE IS INEVITABLE, EXCEPT FROM VENDING MACHINES." Notice that the length and concat methods are executed on the mutation 1 object. wrapper class A class that corresponds to a particular primitive data type. As we have stressed before, you should err on the side of readability. Note the escape sequences used throughout the string. Introduce the Scanner class to create interactive programs. Syntax and Semantics Each program and evaluate the results. If it's not, the println statement is skipped, and processing continues with whatever code follows it. The following two assignment statements give values to the two variables declared above: num = 42; name = new String("James Gosling"); After the new operator creates the object, a constructor is invoked to help set it up initially. The computer 5 6 C H APTE R 1 Introduction ignores any text after the double slash to the end of the line. Logical Operators In addition to the equality and relational operators, Java has three logical operators that produce boolean results. Objects are encapsulated so that they store and manage their own data. Software is the intangible counterpart to the physical hardware components. Then in Chapter 2, in addition to discussing primitive data, we provided some examples of using objects for the services they provide. Label each piece of information in the output. //-----public static void main(String[] args) { 93 94 C H APTE R 3 Using Classes and Objects L I ST I N G 3 .4 continued final double TAX_RATE = 0.06; // 6% sales tax int quantity; double subtotal, tax, totalCost, unitPrice; Scanner scan = new Scanner(System.in); NumberFormat fmt1 = NumberFormat.getCurrencyInstance(); System.out.print("Enter the quantity: "); quantity = scan.nextInt(); System.out.print("Enter the quantity: "); quantity = scan.nextInt(unit price: "); unitPrice = scan.nextDouble(); subtotal = quantity * unitPrice; tax = subtotal * TAX RATE; totalCost = subtotal * TA fmt1.format(totalCost)); } OU T PU T Enter the quantity: 6 Enter the unit price: 1.69 Subtotal: \$10.14 Tax: \$0.61 at 6% Total: \$10.75 operator to create a NumberFormat object and then sets up the object to format values in a particular way and returns it so that it can be used. casting A data conversion in which the type to which a value is time it was referenced. Example Each object has a state, defined by its attributes, and a set of behaviors, defined by its methods. producing inaccurate results f. Example Each object has a state, defined by its methods. Producing inaccurate results f. follow the directions. Your continued love and support keep me going as always. Inheritance is a form of software reuse, capitalizing on the similarities among various kinds of classes that we may want to create. String replace (char oldChar, char newChar) Returns a new string that is identical with this string except that every occurrence of oldChar is replaced by newChar. 5 Java widening conversions 2. Initially, the two variables declared above don't contain any data. The Random number generator. Trailing zeros, such as in the circle's area of 78.540, are not printed using this pattern. Behaviors associated with a bank account probably include the ability to make deposits and withdrawals. inside a box made up of the characters = and | PP 1.5 Write an application that prints a list of four or five websites that you enjoy. If not, the value of num2 is returned and used to initialize larger. Therefore, the following declaration is valid: String city = "London"; That is, for String objects, the explicit use of the new operator and the call to the constructor can be eliminated. SRA 2.8 The four integer data types in Java are byte, short, int, and long. System.out.println("To be or not to be, that is the question."); EX 2.4 What output is produced by the following statement? This overview is intended only to set the stage. That This makes it easier for a programmer to translate (or migrate) an existing C program into Java. Therefore, the operations lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than those above, or they are forced to be executed earlier using pattern's lower in the tree have a higher precedence than the pattern in the tree have a higher pattern in the higher pattern in th Applies the specified pattern to this DecimalFormat object. The comparator interface is examined and demonstrated as well. Software consists of programs use. They can be defined either at the class level (within the class but outside a method), as in this example, or at the outermost level. To use classes from any other Write an application that prints the phrase Knowledge is Power in each of the following three ways: a. The increment operator (++) adds 1 to any integer or floating point value. A program designed to help high school students prepare for the SATs may use random numbers to choose the next question to ask. Adding the printf method is an attempt to make such K EY C ONC EPT migrations easier, and therefore less costly, by providing the same The printf method was added kind of output statement that C programmers have come to rely on. if (total != sum) System.out.println("total does NOT equal sum"); Java also has several relational operators that let us decide the relative ordering between Foundations // // Demonstrates the declaration, initialization, and use of an // integer variable. machine languages assembly languages assembly languages assembly languages assembly languages. Although methods of the Integer class Wrapper class Wrapper classes also provide various methods related to the management of the associated primitive type. The sign of the result of a remainder operation is the sign of the numerator. A software object often represents a real object in our problem domain, such as a bank account. For example, if money is a float variable and dollars is an int variable, then the following assignment statement automatically converts the value 25, then after the assignment, money contains the value 25, then after the assignment, money contains the value 25, then after the assignment, money assignment, money contains the value 25.0. groups of classes that make up a given API might cross packages. For example, in the following code, an int value entered is 47.63 (forty-seven 71 72 C H APTE R 2 Data and Expressions dollars and sixty-three cents), then the program should print the equivalent amount as 4 1 2 2 1 0 3 ten dollar bills five dollar bills five dollar bills five dollar bills quarters dimes nickels pennies PP 2.10 Write an application that prompts for and reads an integer representing the length of a square's side and then prints the square's perimeter and area. Therefore, this type of comment can extend over multiple lines. Java has undergone various will be used in a program so that the fully qualified name is not necessary with each reference. It examines several common graph algorithms and discusses implementation options, including adjacency matrices. K EY C ONC EPT Narrowing conversions should be avoided because they can lose information. IBM promotes a similar IDE called Eclipse (www.eclipse.org). All wrapper classes are defined in the java.lang package. Then determine the least number of each bill and coin needed to represent that amount, starting with the highest (assume that a ten-dollar bill is the maximum size needed). Examples: int total; double num1, num2 = 4.356, num3; char letter = 'A', digit = '7'; final int MAX = 45; Variable Declaration optional initialization type int total = 50; variable name K E Y CO NCEPT A variable is a name for a memory location used to hold a value of a particular data type. We begin by examining a very basic Java program and using it to explore some initial programming concepts. This is the nature of computer memory: Accessing (reading) data leaves the values in memory intact, but writing data replaces the old data with the new. One class can be used to derive several new classes. The hardware components of a computer system are the physical, tangible pieces that support the computing effort. Discuss the support in the Java API for the collection. The assignment operator -= modifies weight by first subtracting 17 from the current value (100) and then storing the result in weight. The number 602 is a numeric value of the specified Expression. If no parameter is passed in, the nextInt method generates a random number across the entire range of int values, including negative numbers. So in this case, calling println with no parameters has the effect of printing a blank line. Figure 3.2 describes some of the packages that are part of the Java standard class library. For example, suppose we wanted to calculate the grade point average of every student in a class fResult = (double) (num1 / num2); k. An object's attributes are the values it stores internally, which may be represented as primitive data or as other objects. SRA 1.5 All of the identifier cannot Answers to Self-Review Questions contain the went wrong. A character literal is expressed in a Java program with single quotation characters, as in 'b' or 'J' or ';'. Instead, it is a series of small cooperating tasks that interact to perform a larger task. The object. The values are identifiers and can be anything desired. At a later point, if we want to change the pattern that the formatter object uses, we can invoke the applyPattern method. The most recent Java 2 Platform, Standard Edition (J2SE) expressions when making decisions. It is sometimes helpful or necessary to convert a data value of one type to another type, but we must be careful that we don't lose important information in the process. The string concatenation operator is the plus sign (+). The following declaration creates a Scanner object that reads input from the keyboard Scanner scan = new Scanner(System.in); This declaration creates a variable called scan that represents a Scanner object. When used alone in a statement, the if-else statement, and the switch statement. The remainder operator % returns the monitor screen. The addition operations are performed before the less than operators, because the arithmetic operators have a higher precedence than the relational operators. They should not belabor the following two declarations: int num --public static void main(String[] args) { int keys = 88; System.out.println("A piano has " + keys + " keys."); } } OU TPUT A piano has 88 keys. EX 3.11 Write code statements that prompt for and read a double value from the user and then print the result of raising that value to the fourth power. A character string is an object in Java that combines a basic operation such as addition with assignment. Older software that still has value is called a legacy system. All programming languages have statements that allow you to make decisions about what to do next. Class libraries can also be obtained separately through third-party vendors. 6 Reading Input Data L I STING 2 .9 continued public static void main(String[] args) { int miles; double gallons, mpg; Scanner scan = new Scanner(System.in); System.out.print("Enter the number of miles: "); miles = scan.nextInt(); System.out.print("Enter the gallons of fuel used: "); gallons = scan.nextDouble(); mpg = miles / gallons; System.out.print("Enter the number of miles: 369 Enter the gallons of fuel used: 12.4 Miles Per Gallon: 29.758064516129032 65 66 to be blocked off to focus special attention // on a particular aspect of your code. Identifiers may be of any length. Figure 2.5 lists the Java widening conversions. 5 Object-Oriented Programming During software design, alternatives need to be considered and explored. SR 2.3 What is the difference between the print method and the println method? types. Although assembly language is an improvement over machine code from a programmer's perspective, it is still tedious to use. CHANGES ARE PERIODICALLY ADDED TO THE INFORMATION HEREIN. Consider the expression result = 3 * ((18 - 4) / 2); In this example, the result is 21. Because enumerated types are special types of classes, they exploration of programming concepts. A computer must be able to understand the instructions in order to carry them out. A boolean value cannot be converted to any other data type be converted to a boolean value cannot be converted to any other data type be converted to any other data type be converted to any other data type. when, at some point in the future, modifications are required. How does it affect program readability? iResult = num3 % num4; o. The blueprint defines the important characteristics of the house—its walls, windows, doors, electrical outlets, and so on. Editors, Compilers, and Interpreters Several special-purpose programs are needed to help with the process of developing new programs. Therefore, in the string "Hello", the index of the character 'H' is zero, and the character in the string "strength entire right-hand side of the assignment is evaluated, and then the result is stored in the variable. Yet they are as valid as less than 1.0. If desired, we can use multiplication to scale the result, cast it into an int value to truncate the fractional part, and then shift the range as we do with integers. SR 3.9 What package contains the Scanner class? That is, an object should be self-governing. Appendix J formally defines the basic syntax rules for the Java programming language, and specific rules are highlighted throughout the text. However, technically, they are not in the language itself. String next() Returns the next input token as a character string. on three lines, one word per line, with the words centered relative to each other c. For now, we will focus on arithmetic expressions that use numeric operands and utilities. Like a class definition, a method is delimited by braces. Executing a program by interpreting its bytecode is still slower than executing machine code directly, but it is fast enough for most applications. First the current value of diameter (5) is multiplied by 4, and then the result is stored in diameter. We'd create one object per employee, each with behaviors and characteristics that we need to represent. The nextInt method can be called with no parameters, or we can pass it a single interface as the basis of comparing objects, are stressed in this chapter. An interpreter is similar to a compiler but has an important difference. This forces that operation to happen first. The translation of source code into (ultimately) machine language for a particular type of CPU can occur in a variety of ways. Likewise, Java assumes that all floating point literals are of type double. a % (b % c) * d * e l. However, even when they are provided, such as the compiler but has an important difference. This forces that operation to happen first. The translation of source code into (ultimately) machine language for a particular type of CPU can occur in a variety of ways. Likewise, Java assumes that all floating point literals are of type double. a % (b % c) * d * e l. However, even when they are provided, such as the compiler but has an important difference. This forces that operation to happen first. requirements need to be discussed and clarified. 69 70 C H APTE R 2 Data and Expressions EX 2.10 Given the following declarations, what result is stored in each of the listed assignment statements? Using classes and objects for the services they provide is a fundamental part of object-oriented software, and it sets the stage for writing classes of our own. First, the subtraction is performed, forced by the inner parentheses. Once a String object is created, its value cannot be lengthened or shortened, nor can any of its characters change. A small part of the source code, such as one statement, is translated and executed. The set of delimiters can be changed if the input tokens are separated by characters other than white space. In that case, the translation process occurs once (for a given version of the program), and the resulting executable program can be run whenever it is needed. A new value overwrites the old one. By convention, uppercase letters are used when naming constants, to distinguish them from regular variables, and individual words are separated using the underscore character. 2 Program Development High-Level Language a + b 1d [%fp-24], %01 add %00, %01, %00 Machine Language ... String m1, m2, m3; m1 = "Quest for the Holy Grail"; m2 = m1.toLowerCase(); m3 = m1 + " " + m2; the result to num3. The first is a string, and the second is the variable keys. Programming languages are generally 1. The comments in Lincoln take the following form: // This is a comment to result = result * (count1 + count2); Likewise, result %= (highest - 40) / 2; is equivalent to result = result % ((highest - 40) / 2); Some assignment operators do. The classes in a class library contain methods that are valuable to a programmer K EY C ONC EPT because of the special SR 3.5 Write a statement that prints the value of a String object called title in all uppercase letters. Each class in the Java API belongs to a particular package. 2. Packages, enumerated types, and wrapper classes are also discussed. Comments should provide insight into the programmer's original intent. Development The process of getting a program running involves various activities. Java is used in commercial environments all over the world. SR 2.11 What is the result of 19%5 when evaluated in a Java expression? Because a character value is unsigned, a negative integer will be converted to a character that has no particular relationship to the class definition are some more comments describing the purpose of the main method, which is defined directly below the comments. The identifiers in the Lincoln program are class, Lincoln, public, static, void, main, String, args, System, out, and println. In Java, many run-time problems are called exceptions that can be caught and dealt with accordingly. Java also has another arithmetic operation: The remainder operator (%) returns the remainder after dividing the second operand into the first. A pseudorandom number generator performs a series of complicated calculations, based on an initial seed value, and produces a number. That way, new results can be computed each time the System.out.println("Whatever you are, be a good one."); } OUTPUTA quote by Abraham Lincoln: Whatever you are, be a good one. All of the assignment operation. When the program is executed, it calls the println method to print the first statement, then it calls that method again to print the second statement, and then, because that is the last line in the main method, the program terminates. For example, the += operator can be used as follows: total += 5; This performs the same operation as the statement total = total + 5; The right-hand side of the assignment issues\",\t" + "So I'd rather just be friends\tAt this point in our " + "relationship."); } OU TPUT Roses are red, Violets are blue, Sugar is sweet, But I have "commitment issues", So I'd rather just be friends At this point in our relationship. The ASCII character set is a popular choice. It reads in a sales transaction and computes the final price, including tax. Topics include instance data, visibility, scope, method parameters, and return types. For example, consider the following sentence: Time flies like an arrow. Programmers often concentrate so much on writing code that they focus too little on documentation. In other words, the assignment operator has a lower precedence than any of the data, such as a number, character, or boolean. However, it is not a replacement for an if-else statement because the operands to the ?: operator has only one operator has two. fResult = (int) ((double) num1 / num2); n. ecution on that machine. An unary operator has only one operand, whereas a binary operator has two. fResult = (int) ((double) num1 / num2); n. ecution on that machine. Therefore, if it is important to maintain a value such as 50341.2077 accurately, we need to use a double. Inline documentation should provide insight into your code. Both of the latter examples show poor style and make the program difficult to understand. Listing 3.6 shows a program called IceCream that declares an enumerated type and exercises some of its methods. Their value doesn't change. Either the value stored in count is greater than 20 or it's not. If you were to miss any uses of the literal value, problems would surely arise. The if-else Statement Sometimes we want to do one thing if a condition is true and another thing if that condition is false. You may be asked to adhere to particular guidelines K EY C ONC EPT when you write your programs. The principles of object-oriented software 1. Execute statements repetitively using while, do, and for loops. Java uses the 16-bit Unicode character set to represent character data. black&white f. Max Value byte 8 bits -128 127 short 16 bits -32,768 32,767 int 32 bits -2,147,483,648 2,147,483,647 long 64 bits -9,223,372,036,854,775,808 9,223,372,036,854,775,807 float 32 bits Approximately -1.7E+308 with 7 significant digits Approximately 1.7E+308 with 15 significant digits Approximately 1.7E+308 with 15 significant digits Approximately 3.4E+38 with 15 significant digits Approximately -1.7E+308 with 15 significant digits -1.7E+308 with 15 s primitive types 47 48 C H APTE R 2 Data and Expressions When designing programs, we sometimes need to be careful about picking variables of appropriate size so that memory space is not wasted. More information about javadoc is given in Appendix I. SRA 2.7 An integer variable can store only one value at a time. (total > MAX)? The String and Math classes are part of the java.lang package. The program has to be written in the appropriate programming language, such as Java. Because we are printing particular values, we could simply have included the numeric value as part of the string literal, as in "Speed of ketchup: 40 km per year" Digits are characters and can be included in strings as parts of early Java technologies have been deprecated, which means they are considered old-fashioned and should not be used. //public static void main(String[] args) { Flavor cone1, cone2, cone3; cone1 = Flavor.rockyRoad; cone2 = Flavor.chocolate; System.out.println("cone1 value: " + cone1); System.out.println("cone1 ordinal: " + cone1.ordinal()); System.out.println("cone2 value: " + cone2.name()); System.out.println("cone2 ordinal()); value: " + cone3); System.out.println("cone3 ordinal: " + cone3.ordinal()); System.out.println("cone3 ordinal: 5 cone1 name: rockyRoad cone2 value: chocolate cone2 ordinal: 5 cone3 name: rockyRoad cone2 value: chocolate cone3 ordinal: 5 cone3 name: rockyRoad cone2 value: chocolate cone3 ordinal: 5 cone3 name: rockyRoad cone2 value: chocolate cone3 ordinal: 5 cone3 name: rockyRoad cone3 ordinal: 7 cone3 name: rockyRoad cone3 ordinal: 8 cone3 name: rockyRoad cone3 name: rockyRoad cone3 ordinal: 8 cone3 name: rockyRoad cone3 name: rockyRoad cone3 ordinal: 8 cone3 name: rockyRoad APTE R 3 Using Classes and Objects 3.8 Wrapper Classes and objects 3.8 Wrapper Classes and objects. Generally, each assembly language instruction corresponds to an equivalent machine language instruction. Testing in one form or another should be a part of every stage of development. Even without knowing what roster represents, or from what class it was created, we can see that it has at least three methods: getSize, expand, and addName. K EY C ONC EPT Comments do not affect a program's processing; instead, they serve to facilitate human comprehension. The second declaration creates a String variable that holds a reference to a String object. SR 1.4 What is white space? remove the last brace in the program PP 1.3 Write an application that prints, on separate lines, your hobbies, your favorite movie. Software requirements specify what a program must accomplish. The difference between print and println is small but important. program A series of instructions that a computer executes one at a time. The comments in the Lincoln program of two types of comments allowed in Java. Numeric literals of type double can be followed by a D or d if desired. 2 Program Development All three versions of Lincoln are technically valid and will execute in the same way, but they are radically different from a reader's point of view. Remember that the println method moves to the beginning of the next line after the information passed to it is printed. The next line after the information passed to it is printed. parameter. Each class is part of a particular package. The average human is likely to interpret this sentence as a general observation: that time moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that an arrow moves quickly in the same way that are same way that an arrow moves quickly in the same way that are same wa E Y CO NCEPT Inline documentation should provide insight into your code. All references to the object cannot be used again in the program. Chapter 22 (Sets and Maps) explores these two types of collections and their importance to the Java Collections API. Unicode character set A character set used to represent characters and symbols from most of the world's written languages. However, it is crucial to use white space appropriately to make a program readable to humans. In this case, the resulting floating point value will be a rounded version of the integer value, following the rounding techniques defined in the IEEE 754e floating point standard, autoboxing The automatic conversion of a primitive type to an object of its corresponding wrapper class. Objects are the fundamental elements that make up a program. Adelson-Velskii, Georgii and Evengii Landis. The Math class is defined in the java standard class library, xi Contents Prefacevii Creditsxxix VideoNotesxxxi Chapter 1 Introduction 1 1.1 The Java Program Development 11 Programming Language 2 A Java Programming Language 3 A Java Programming 3 A Java Programming 1 A J Problem Solving 18 1.4 Software Development Activities 20 1.5 Object-Oriented Programming 21 Object-Oriented Software Principles 22 Chapter 2 Data and Expressions 2.1 2.2 33 Character Strings 34 The print and println Methods String Concatenation Escape Sequences 34 36 40 Variables and Assignment 41 Variables 41 The Assignment Statement 44 Constants 46 xiii xiv CONTENTS 2.3 Primitive Data Types 47 Integers and Floating Points 47 Characters 48 Booleans 50 2.4 Expressions Arithmetic Operators Operators Operators Operators 2.5 2.6 Data Conversion 58 Conversion Techniques 60 Reading Input Data 61 The Scanner Class 61 Chapter 3 Using Classes and Objects 3.1 51 52 56 57 Creating Objects 75 76 Aliases 78 3.2 The String Class 89 3.6 3.7 3.8 Formatting Output 92 The NumberFormat Class The DecimalFormat Class The printf Method 92 94 96 Enumerated Types 97 Wrapper Classes 100 Autoboxing 102 Chapter 4 Conditionals and Loops 4.1 111 Boolean Expressions 112 Equality and Relational Operators Logical Operators 113 114 CO N T E N T S 4.2 The if Statement The if-else Statement Using Block Statements The Conditional Operators Nested if Statements 4.3 116 119 121 124 125 Comparing Data 127 Comparing Floats Comparing Characters Comparing Objects 127 128 4.4 The switch Statement 130 4.5 The while Statement 134 Infinite Loops Other Loops Comparing Characters Comparing Characters Comparing Characters Comparing Characters 145 Reading Text Files 146 4.7 The do Statement 151 Iterators and for Loops Comparing Characters 5 Writing Classes 5.1 5.2 5.3 5.4 169 Classes and Objects Revisited 170 Identifying Classes and Objects Assigning Responsibilities 171 173 Anatomy of a Class 173 Instance Data UML Class Diagrams 178 179 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In this example, the expression is simply a number, 10. remove the semicolon at the end of the println statement h. order to be executed. For example, if we pass 100 as a parameter to nextInt, we'll get a return value that is greater than or equal to 0 and less than or equal to 99. 1780. Any method of the String class can be executed on any String object, but for any given K EY C ONC EPT invocation, the method is executed on a particular programming activities. There are many different editors with many different features. generator.nextInt(100) - 50 105 106 C H APTE R 3 Using Classes and Objects EX 3.7 Write code to declare and instantiate an object of the Random class (call the object reference variable rand). For example, if the value of a particular variable will not vary outside of a range of 1 to 1000, then a twobyte integer (short) is large enough to accommodate it. We explore object-oriented approach is the fact that objects can be used quite effectively to represent real-world entities. Every object has a state and a set of behaviors. The first parameter to the method represents the format string, and the remaining parameters specify the values that are inserted into the format string. Likewise, if found is false. The Java language is strongly typed, which means that we are not allowed to assign a value to a variable that is inconsistent with its declared type. The other wrapper classes contain similar constants for their types. 4 Truth table describing the logical AND and OR operators 115 116 C H APTE R 4 Conditionals and Loops done count > MAX !done !done && (count > MAX !done !done)done && (count > MAX !done !done |done table for a specific condition An important characteristic of the && and || operators is that they are "short-circuited" in Java. It then prints out the current value of sides. if (total == sum) System.out.println("total equals sum"); Likewise, the following if statement prints a sentence only if the variables total and sum do not contain the same value. The two basic comment types can be used to create various documentation styles, such as // This is a comment on a single line. Testing includes running a program multiple times with various inputs and carefully scrutinizing the results. A name in Java is a series of identifiers separated by the dot (period) character. Comments should be well written, often in complete sentences. If a method is not static, it can be executed only through an instance (an object) of the class. The two plus signs that make up the operator cannot be separated by white space. Chapter 17 (Recursion) is a general introduction to the

concept of recursion and how recursive solutions can be elegant. strongly typed A programming language characteristic that prevents a variable from being assigned a value inconsistent with its type. method A group of programming statements that is given a name. For example, if we want to divide the integer value total by the integer value count and get a floating point result, we can do it as follows: result = (float) total / count; First, the cast operator returns a floating point think,

the + operator is also used for arithmetic addition. Program code that plays this role is technically pseudorandom, because a program has no means to actually pick a number randomly. Java follows a well-defined set of precedence rules that governs the order in which operators will be evaluated in an expression. is a boolean condition. This

```
communicates to a human reader that the assignment statement is part of the if statement; it implies that the if statement governs whether the assignment statement will be executed. If no error messages are produced, explain why. The previous edition focused on Swing and had an introduction to JavaFX. 1.3 Problem Solving Creating software.
involves much more than just writing code. Parentheses can be nested, and the innermost nested expressions are evaluated first.
be changed once they are set. The changes in this edition include: • A brand new Chapter 6 on developing GUIs using JavaFX. The first value in an enumerated type has an ordinal value of 1, the third has an ordinal value of 2, and so on. A program is written in a particular programming language that uses specific
 words and symbols to express the problem solution. Output the results to three decimal places. Two of the methods in the NumberFormat class, getCurrencyInstance and getPercentInstance, return an object that is used to format numbers. The Java language is accompanied by a library of extra software that we can use when developing programs.
The role of 4. F IGURE 3. static double random () Returns a random number between 0.0 (inclusive) and 1.0 (exclusive). Note that the numbers in those lines are not enclosed in double quotation characters and are therefore not character strings. change Emergency to 
make the changes; thus, someone completely unfamiliar with the program will need to understand it. semantics Rules that define what a statement in a language means. For example, the Integer class contains a static method called parseInt that converts an integer that is stored in a String to its corresponding int value. 2 Java logical operators 4.
 Each programming language supports a particular character set that defines the valid values for a character variable in that language. SRA 3.15 The following statement prints the sine of 1.23 radians. 1995.
method, which is where processing begins. You cannot have any characters between the two slashes. total + 1: total * 2; Preceding the ? A Java compiler translates Java source code into Java bytecode, a low-level, architecture-neutral representation of the program. "jGRASP" is developed by the Department of Computer Science and Software
System.out.println("Whatever you are, be a good one.");}} OU T PU T A quote by Abraham Lincoln: Whatever you are, be a good one. As you might imagine, the use of identifiers that are too long is a much less prevalent problem than the use of identifiers that are too long is a much less prevalent problem.
----// Prints a presidential quote. How are they different? The declaration also gives keys an initial value of 88. All numeric types are signed, which one class can be derived from another. For example, suppose we wanted to represent the
various letter grades a student could earn. Sorting is discussed in Chapter 13. The program in Listing 4.4, called MinOfThree, uses nested if statements to determine the smallest of three integer values entered by the user. Hint: Think through the easiest way to construct the phone number. The NumberFormat class provides a student could earn.
generic formatting capabilities for numbers. Comments included in a program are called inline documentation. One advantage of this technique is that it eliminates the need for a separate compilation phase. System.out.print("Another."); System.out.print("Test this if you are not sure."); System.out.print("Another.");
 System.out.println(); System.out.println("All done."); Exercises EX 2.3 What is wrong with the following program statement? After the assignment operation is compilers are good at giving clear messages about this problem. The expression on the right-hand side of the operator is
 evaluated, that result is added to the current value of the variable on the left-hand side, and that value is stored in the variable. SRA 2.2 A string literal is a sequence of character set defines the valid characters that a particular type of
computer or programming language will support. The class used to define an object can be thought of as the type of an object. That translation may result in errors, in which case you return to the editor to make changes to the code to fix the problems. Until we truly know what problem we are trying to solve, we can't actually solve it. The classes in
the java.net package support network communication, and the classes in the javax.swing class support the development of graphical user interfaces. Why should it be changed? It can be used wherever an object is needed in a program rather than a primitive type. The remainder operator is sometimes called the modulus operator. Note that some of
the String methods, such as charAt, refer to the index of a particular character. Like a conditional, a loop is based on a boolean expression that determines how many times the statement is executed. Programming Language Levels Suppose a particular person is giving travel directions to a friend. This unified approach makes the important
introductory sequence more cohesive and accessible for students. Im Implementing the design, erand is not evaluated. The underscore character (as in answer 7) is a valid part of an identifier, static double num) static double num static doubl
Enumerated Types L I STING 3.6 continued public class IceCream { enum Flavor {vanilla, chocolate, strawberry, fudgeRipple, coffee, rockyRoad, mintChocolateChip, cookieDough} //-
                                                                                                                                                                                                                                                                                                                  // Creates and uses variables of the Flavor type. However, the Math class does not have a method that returns an integer
or lets you specify the range of the result, as Random does. It then explores the techniques for P R E FAC E establishing a connection between a Java program and a database, and the API used to interact with it. The class definition runs from the first opening brace ({) to the final closing brace ({) to the f
problem fixed, the credit card company apologizes for the "computer error." Did the computer arbitrarily add a zero to the end of the number, or did it perhaps multiply the value by 10? If the age is less than the value of the constant MINOR, the statement about youth is printed. Some environments are referred to as integrated development
environments (IDEs) because they integrate various tools into one software program. The mechanics of editing and running a program are necessary steps, but the heart of software development is problem solving. A conditional statement will be executed next
Good documentation is therefore essential. 3.6 Formatting Output The NumberFormat class and the DecimalFormat class are used to format information so that it looks appropriate when printed or displayed. Give some examples. The last three calls to println in the Facts program demonstrate another interesting thing about string concatenation
strings and numbers can be concatenated. These characters are called the input delimiters. If our programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results to The programs are K EY C ONC EPT wrong or our data inaccurate, then we cannot expect the results are the program of t
made to it over time. Programming languages can be categorized into the following four groups. For example, the constant describing the maximum occupancy of a theater could be declared as follows: final int MAX OCCUPANCY = 427; The compiler will produce an error message if you attempt to change the value of a constant once it has been
given its initial value. We design separate pieces that are responsible for certain parts of the solution, and then we integrate them with the other parts. F IGURE 3.3 Some methods of the Random class of a die, we might want a random number in the range of 1 to 6. In general, problem solving consists of multiple steps: 1. There can be no space
between the slash and the asterisk. bytecode A low-level representation of a Java program that is not tied to a specific type of CPU. There are many situations in which it's helpful to have multiple references to objects. javafx.scene.shape Define shape objects (circles, rectangles, etc.) for graphics programs. 25 26 C H APTE R 1 Introduction
                                                                                                                                                                                                         --public static void main(String[] args) { String phrase = "Change is inevitable"; String mutation1, mutation2, mutation3, mutation4; System.out.println("Original string: \"" + phrase + "\"");
System.out.println("Length of string: " + phrase.length()); mutation1.toUpperCase(); mutation2.replace('E', 'X'); mutation3.substring(3, 30); // Print each mutated string System.out.println("Mutation System.out.println(
 System.out.println("Mutation System.out.println("Mutation System.out.println("Mutation #1: #2: #3: #4: " " " + + + + mutation #1; Mutation #1: Change is inevitable, except from vending machines. The time
 has come to switch over completely to the new approach, which simplifies GUI development and provides better opportunities to discuss object-oriented programming. A research group at Auburn University has developed jGRASP, a free Java IDE. SR 2.7 How many values can be stored in an integer variable at one time? human readability; it shows
the relationship between one statement and another. (a - (b - c)) - d Programming Projects j. Keep in mind that this is an expression that returns a value, and usually we want to do something with that value, such as assign it to a variable: total = (total > MAX)? Exercises SR 3.14 What is a class method (also called a static method)? EX 3.2 Write a
statement that prints the eighth character of a String object called introduction. SRA 3.2 A null reference is a reference that does not refer to any object. The characters to be printed are represented as a character string, enclosed in double quote characters ("). However, although they may seem to be sequential, they are almost never completely
linear in reality. The semantics of a statement in a programming language define what will happen when that statement is executed. The pattern defined by the string "0.###", for example, indicates that at least one digit should be printed to the left of the decimal point and should be a zero if the integer portion of the value is zero. Therefore, this
assignment statement increments, or adds 1 to, the variable count. This occurs in situations where memory space is particularly restricted, such as a program that runs on a embedded device. In this case, the println method takes only one parameter: the string of characters to be printed. Figure 4.6 shows this processing. Don't print any unneeded
characters. Self-Review Questions character set A list of characters in a particular order. Summary of Terms ASCII character set for representing English character set a programming statement over and over again. //-
public static void main(String[] args) { int a, b, c; // ax^2 + bx + c double discriminant, root1, root2; Scanner scan = new Scanner(System.out.print("Enter the coefficient of x: "); b = scan.nextInt(); System.out.print("Enter the coefficient of x squared: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x squared: "); a = scan.nextInt(); System.out.print("Enter the coefficient of x: "); b = scan.nextInt(); System.out.print("Enter the coefficient of x squared: "); a = scan.nextInt(); System.out.print("Enter the coefficient of x: "); b = scan.nextInt(); System.out.print("Enter the coefficient of x squared: "); a = scan.nextInt(); System.out.print("Enter the coefficient of x: "); b = scan.nextInt(); System.out.print("Enter the coefficient of x: "); b = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); b = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.nextInt(); System.out.print("Enter the coefficient of x: "); c = scan.ne
the quadratic formula to compute the roots. Chapter 19 (Trees) provides an overview of trees, establishing key terminology and concepts. SRA 1.3 Java bytecode is a low-level representation of a Java source code program. Why is ambiguity a problem for programming languages? Assuming that the variable generator refers to an object of the Random
several chapters. Answers to Self-Review Questions SRA 3.12 A call to the nextInt method of a Random object returns a random integer in the range of all possible int values, both positive and negative. Chapter 11 (Analysis of Algorithms) lays the foundation for determining the efficiency of an algorithm and explains the important criteria that allow a
developer to compare one algorithm to another in proper ways. For example, the condition in the following if statement will not attempt to divide by zero if the left operand is false. javafx.scene.control Define graphical user interface controls such as buttons and sliders. It simply represents the concept of a void reference. The results Methods are
often executed on a of executing toUpperCase on mutation1 would be very different from particular object, and that object's the results of executing toUpperCase on mutations. Enjoy."); System.out.println("Age is a state of mind."); } } OU T PU
T Enter your age: 43 You entered: 43 Age is a state of mind. It also indicates that the fractional portion of the value should be rounded to three digits. This is referred to as lexicographic order. The compiler also tries to find other problems, such as the use of incompatible types of data. In any other case, attempting to assign a primitive value to an
object reference variable, or vice versa, will cause a compile-time error. widening conversion A conversion between one data type and another in which information is not lost. An important situation arises with nested if statements. Too many programmers focus on implementation exclusively, when actually it should be the least creative of all
development activities. encapsulation The characteristic of an object that means it protects and manages its own information. 15 16 C H APTE R 1 Introduction Sun Microsystems, the creator of the Java Development Kit
(JDK). The ordinal values are used internally only, inheritance Defining a class based on another that already exists. Any written comments or documents, including a user's guide and technical references, are called documents to
read and write. 1974. Various software tools can be used to help with all parts of the development process, as well. Having two categories of data to manage (primitive values and object references) can present a challenge in some circumstances. SR 2.6 What is a variable declaration? //-
main(String[] args) { final int MINOR = 21; Scanner scan = new Scanner(System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MINOR) System.out.println("You entered: " + age); if (age < MI
constants, variables, or other sources of data. Occasionally, behind the scenes, the Java environment executes a method that "collects" all the objects marked for garbage collection and returns their memory to the system for future use. Identifiers and Reserved Words The various words used when writing programs are called identifiers. We discuss
 allows subsequent output to appear on the same line. If both operands are integers, the / operator performs integer division, meaning that any fractional part of the result is discarded. Common characteristics are defined in high-level classes, and specific differences are defined in derived classes. These rules must be followed in order to create a
program. 75 76 C H APTE R 3 Using Classes and Objects At the end of Chapter 1 we presented an overview of objects. This chapter discusses several such statements, as well as exploring some issues related to comparing data and objects. What
does that mean? Discuss ways to format output using the NumberFormat and DecimalFormat classes. That expression evaluates to a boolean (true or false) result. If the left operand is. Both assembly language and machine language
are considered low-level languages. Explore boolean expressions that can be used to make decisions. Chapter 1 (Introduction) introduces the Java programming language and the basics of program development. The need to make decisions like this comes up all the time in programming situations. It was developed in the early
1990s by James Gosling at Sun Microsystems. (One mile equals 1.60935 kilometers.) Read the miles value from the user as a floating point value. Comments in more detail. Java API A library of software that we can use when developing programs. //--
args) { final int BASE = 32; final double CONVERSION FACTOR = 9.0 / 5.0; double fahrenheitTemp; int celsiusTemp = 24; // value to convert fahrenheitTemp); } } OU TPUT
Celsius Temperature: 24 Fahrenheit Equivalent: 75.2 55 56 C H APTE R 2 Data and Expressions Note that in the TempConverter program, the operands to the division operation are floating point literals to ensure that the fractional part of the number is kept. For an expression to be syntactically correct, the number of left parentheses must match
the number of right parentheses, and they must be properly nested. But remember, object variables hold the address of an object, and it is the address that gets copied. Print the output to four decimal places. SR 2.9 What is a character set? remove the first quotation mark in the string d. If a programming language instruction could have two different
meanings, a computer would not be able to determine which one should be carried out. It can hold one of the four Season values, but nothing else. It might not even be clear to you two months after you wrote it! K EY C ONC EPT Identifier names should be descriptive and readable. 6 Formatting Output String format (double number) Returns a
string containing the specified number formatted according to this object's pattern. Java has a syntax similar to that of the programming languages. The System.out object represents an output device or file, which by default is the monitor screen.
Chapter 5 (Writing Classes) explores the basic issues related to writing classes and methods. Chapter 21 (Heaps and Priority Queues) explores the concept, use, and implementations of heaps and specifically their relationship to priority queues.
format for the current locale. After the arithmetic operations are complete, the computed result is stored in the variable on the left-hand side of the assignment operator (=). Each piece of data that we send to a method is called a parameter. Let's examine how we declare and use them in a program. //-
static void main(String[] args) { Random generator.nextInt(10); System.out.println("A random integer: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; System.out.println("From 1 to 10: " + num1); num1 = generator.nextInt(10) + 1; Sys
 generator.nextInt(15) + 20; System.out.println("From 20 to 34: " + num1); num1 = generator.nextInt(20) - 10; System.out.println("From -10 to 9: " + num2); num2 = generator.nextFloat() * 6; // 0.0 to 5.999999 num1 = (int)num2 + 1;
System.out.println("From 1 to 6: " + num1); } 3. A heap sort is used as an example of its usefulness as well. Listing 2.6 shows a program called Geometry. However, several methods in the String objects that are the result of modifying the original string's value. 0 to 500 c. Explain. natural language A language that humans
use to communicate, such as English. String author = "Fred Brooks"); For strings, this declaration could have been abbreviated as follows: author "Fred Brooks" SRA 3.5 The following statement prints the value of a String object in all
uppercase letters. method invocation Calling a method to execute its code. However, these initial requirements are often incomplete, ambiguous, and perhaps even contradictory. One... "The Design and Analysis of Computer Algorithms." Addison-Wesley. The previous statement is functionally equivalent to, but sometimes more convenient than, the
 following: if (total > MAX) total = total + 1; else total = total * 2; Now consider the declaration int larger = (num1 > num2)? The && operator performs a logical AND operation. Then, count is treated as a floating point value via arithmetic promotion. We discuss expressions that are more involved than this in the next section.
                 -// Reads the user's age and prints comments accordingly. The ! operator is used to perform the logical NOT operation, which is also called the logical complement. • A new Appendix G that
 explores the JavaFX Scene Builder, a drag-anddrop application for developing graphical front ends. The pattern %s matches the string parameter name. If Statement boolean condition executed if the condition is true if (total 36.238) delta = 100; else System.out.println("WARNING: Delta is being reset to ZERO"); delta = 0; // not part of the else
clause! The indentation (not to mention the logic of the code) implies that the variable delta is reset only when depth is less than 36.238. multiplying two numbers when you meant to add them b. Aliases can produce undesirable effects unless they are managed carefully. In these cases, the number is automatically converted to a string, and then the
any case, you should adopt and conyou format and document your sistently use a set of style guidelines that increases the readability programs. The Age program echoes the age value that is entered in all cases. Each programming statement in the main method is executed, one at a time in order, until the end of the method is reached. Compute the
distance between the two points using the following formula: PP 3.5 Distance = 2(x2 - x1)2 + (y2 - y1)2 Write an application that reads the syntax rules of the language. Understand the problem. A random number generator picks a number
at random out of a range of values. 1 Java equality and relational operators The equality and relational operators have lower precedence than the arithmetic operators a solid understanding of the following terms:
attribute me method me class me encapsulation me inheritance me polymorphism In addition to these terms, there are many associated concepts that allow us to tailor our solutions in innumerable ways. 4 3 pr 3 Surface area = 4pr 2 Volume = PP 3.6 Write an application that reads the lengths of the sides of a triangle from the user. A Java
program must be syntactically correct or the compiler will not produce bytecode. It discusses the conversion of data from one type to another, and how to read input interactively from the user running a
defines a set of rules that determines exactly how a programmer can combine the words and symbols of the language into programming statements, which are the instructions that are carried out when the program is executed. Yet in many ways they are the "same" house. If the String object str holds the string "987", the following line of code
 The effort put into design is both crucial and cost-effective. A class is a blueprint of an object. EX 3.10 Write code statements to create a DecimalFormat object that will round a formatted value to four decimal places. Increment and Decrement Operators There are two other useful arithmetic operators. SR 1.2 What is the relationship between a high
short because a byte is stored in 8 bits and a short is stored in 16 bits. totVal c. This text is designed to help you increase your understanding of these concepts gradually and naturally. This inK EY C ONC EPT dentation is extremely important for human readability, although it Proper indentation is important for is ignored by the compiler. We can say
that we send the println message to the System.out object to request that some text be printed. results of 10.0/4 and 10/4.0 and 10/
data, such as a list of names, in alphabetical order. Multiplication, division, and the remainder operator all have equal precedence and are performed before (have higher precedence than) addition and subtraction. fResult = val1 / val2; g. The unary + operator is rarely used. Therefore, the developers of the Java programming language chose the
Unicode character set, which uses 16 bits per character, supporting 65,536 unique characters. Errors can occur at various stages of this process and must be fixed. The choice of which development environment to use is important. Machine language code is expressed as a series of binary digits and is extremely difficult for humans to read and write.
name by which we refer to that location. weight -= 17; SR 2.15 Why are widening conversions safer than narrowing conversions? VideoNote Comparison of Java IDEs The SDK tools are not an integrated environment. The original code is called source code, and the language into which it is translated is called the target language. The fact that the
                                                                                                                                                                                      System.out.println("Bilbo") System.out.println("Frodo"); Without the semicolon on the first line, the compiler doesn't realize that a new statement has begun. SRA 1.2 High-level languages allow a programmer to
 express a series of program instructions in English-like terms that are relatively easy to read and use. K EY C ONC EPT Problem solving involves breaking a solution down into manageable pieces. Area = 2(s(s - a)(s - b)(s - c) Answers to Self-Review Questions SRA 3.1 The new operator creates a new instance (an object) of the specified class. The basic
ASCII set uses 7 bits per character, providing room to support 128 different characters, including the lowercase letters, such as 'a', 'b', and 'c' through '9' th
the ampersand ('&'), vertical bar ('|'), and backslash ('\') control characters, such as the carriage return, null, and end-of-text marks The control characters because they do not have a specific symbol that represents them. For example, it's easy to forget the concatenation operator between a
string and a numeric value, or to use a comma as though they were separate parameters: System.out.println("The total is", total); This will cause the compiler to issue an error. Note that the equality operator consists of two equal signs. It must first be
translated into machine language. 103 104 C H APTE R 3 Using Classes and Objects import declaration A programming statement used to specify which external classes (from which packages) are used in a program. It contains an introduction to object-oriented development, including an overview of concepts and terminology. However, if we
library is a set of classes that supports the development of programs. K EY C ONC EPT A loop allows a program to execute a statement multiple times. We must always consider alternatives and refine the solution as necessary. They may also apply constraints to the program, such as how fast a task must be performed. if (size >= MAX) size = 0; They may also apply constraints to the program, such as how fast a task must be performed. if (size >= MAX) size = 0; They may also apply constraints to the program, such as how fast a task must be performed. if (size >= MAX) size = 0; They may also apply constraints to the program to execute a statement multiple times.
condition of the following if statement first adds three value or an object. Some methods do not return a value. Once the blueprint is created, several houses can be built using it, as depicted in Figure 1.5. In one sense,
the houses built from the blueprint are different. This approach has the distinct advantage of making Java architecture-neutral and therefore easily 1. 4 The Random () Constructor: creates a new pseudorandom number generator. Not all programming languages shortcircuit these operations, and such code would produce a divide-by-
zero error in those languages. If it is, the overtime hours are paid at a rate one and a half times the normal rate. deprecated An element that is considered old-fashioned and should not be used. fResult = num1 / num4; c. In this case, the name of the method is main and it contains only two programming statements. 0000 1111 0010 1111 0000 0000
1110 0000 1110 0000 0111 1000 0011 1000 0011 1000 0000 F IGU RE 1.2 A high-level expression and its assembly language equivalents. Do not let the first three digits contain an 8 or 9 (but don't be more restrictive than that), and make
simply on the number of hours worked and the standard rate. As you can see by the output of the GasMileage program, the calculation produces a floating point result that is accurate to several decimal places. Constants are, to use the English meaning of the word, not variable. Suppose the current value of a variable called count is 15 when the
following assignment statement is executed: count = count + 1; Because the right-hand expression is evaluated first, the original value of count is obtained and the value 1 is added to it, producing the result 16. class library A set of software classes that can be used when developing programs (see Java API). SRA 2.12 The result of 13/4 in a Java
expression is 3 (not 3.25). Chapter 11: Text: Another way of looking at the effect of algorithm complexity was proposed by Aho, Hopcroft, and Ullman. That is, if their left operation, the right operators can be used to sufficient to decide the boolean result of 13/4 what is the result of 13
when evaluated in a Java expression? The calculation is the same for each student; it is just performed on different data. If money contained the value 84. When we are developing a software solution to a problem, the implementation stage is the process of actually writing the program
-// Prints various facts. Appropriate use of white space makes a program easier to read and understand. After the assignment, both name1 and name2 contain the same object: name1 "Ada, Countess of Lovelace" name2 The name1 and name2
reference variables are now aliases of each other because they are two different variables that refer to the same object. An application uses animation to demonstrate the efficiency of sorting algorithms. If the condition is false, the statement controlled by the condition is skipped, and processing continues immediately with any statement that follows:
and executed, and so on. Therefore, much like machine language, each assembly language instruction accomplishes only a simple operation. Early programmers found these techniques to be time-consuming and error-prone. The expanded discussion drives home the need to separate the iterator functionality from the details of any particular
and interpretation are executed on the command line. The first operator concatenates the string with the first number (24), creating a larger string. It clarifies the distinction between the way it might be implemented from scratch. The condition is enclosed in parentheses and must evaluate to
true or false. The Scanner class is part of the java.util class library. All of the numeric types differ in the amount of memory space used to store a value of that type, which determines the range of values that can be represented. The following examples are not valid expressions: result = ((19 + 8) % 3) - 4); // not valid result = (19 (+ 8 %) 3 - 4); // not
valid Keep in mind that when a variable is referenced in an expression, its current value is used to perform the calculation. For example, the result of 10/4 is 2, but the types of the operands. DE S IGN F O C U S One important implication of aliases is that when we use one reference to change an object, it is also changed for the other reference,
----// Prints two lines of output representing a rocket countdown. int iResult, num1 = 25, num2 = 40, num3 = 17, num4 = 5; double fResult, val1 = 17.0, val2 = 12.78; a
Chapter 25 (Databases) explores the concept of databases and their management, and discusses the basics of SQL queries. Of course not. byte byteValue () long longValue () lon
example, the following statement computes the absolute value of the number stored in total, adds it to the variables mutation3.substring, respectively: mutation3 and mutation4 are initialized by the calls to mutation2.replace and mutation3.substring, respectively: mutation3
 "CHANGX IS INXVITABLX, XXCXPT FROM VXNDING MACHINXS." mutation4 "NGX IS INXVITABLX, XXCXPT F" 3.3 Packages We mentioned earlier that the Java language is supported by a standard class library that we can make use of as needed. Operator Precedence Operators can be combined to create more complex expressions. class library
A set of classes that supports the development of programs. In such cases, we can choose a variable's data type accordingly. The next method of the Scanner class reads the next input token as a string and returns it. Although we won't be able to cover all aspects of the library, we will explore many of them. Figure 1.1 lists all of the Java reserved
words in alphabetical order. The program shown in Listing 2.1 is called Countdown, and it invokes both the println method and the println
StringMutation program, keep in mind that this is not a single String object that changes its data; this program creates five separate String objects using various methods of the String object that changes its data; this program creates five separate String objects using various methods of the String object that changes its data; this program creates five separate String objects using various methods of the String object that changes its data; this program creates five separate String objects using various methods of the String objects using various methods of the String object that changes its data; this program creates five separate String objects using various methods of the String objects usin the String objects using various methods of the String objects 
random (because they are calculated), the values produced by a pseudorandom number generator usually appear random—at least random enough for most situations. MICROSOFT AND/OR CHANGES IN THE PRODUCT(S) AND/ OR THE PROGRAM(S) DESCRIBED HEREIN AT
ANY TIME. In this way, object-oriented programming enables us to map our programs to the real situations that the programs represent. In the 1980s and 1990s, object-oriented programming became wildly popular, largely because of the development of programming languages such as C++ and Java. For example, the program code could guard
 against the possibility of dividing by zero and handle the situation appropriately if it arises. The uppercase and lowercase versions of a letter are distinct. Following the ? From To byte char short, char, int, or long double byte, short, char, int, long, or
float F IGURE 2. Although widening conversions do not lose any information about the magnitude of a value, the more productive you can be during program development. On the other hand, the natural
languages that humans use to communicate, such as English and Italian, are full of ambiguities. A computer language cannot allow such ambiguities to exist. runtime error An error that occurs during program execution and causes the program to terminate abnormally. We don't instantiate a NumberFormat object by using the new operator. In this
text, we refer to classes primarily in terms of their package organization. You should always strive to make the logic of your program extremely clear to anyone reading your code. The process of finding and correcting defects in a program extremely clear to anyone reading your code. The process of finding and correcting defects in a program is called debugging. The Addition program shown in Listing 2.3 demonstrates the distinction between string
concatenation and arithmetic addition. If a program is not syntactically correct, the compiler will issue error messages and will not produce bytecode. K EY C ONC EPT This text focuses on the principles of object-oriented programming. 2
Software is the programs that are executed by the hardware and the data that those programs use. 1 Boolean Expressions 113 a conditional statement is to evaluate a boolean condition (whether the person smokes) and then to execute the proper calculation accordingly. ASCII stands for the American Standard Code for Information Interchange. We
-// Prints a string and various mutations of it. 25 to 50 f. They also take boolean operands. java.io Perform a wide variety of input and output functions. The new operator returns a reference After these assignments are executed, the variables can be depicted to a newly created object. Other String methods are discussed in the next
 section. Casting is the most general form of conversion in Java. Individual characters can be treated as separate data items, and, as we've seen in several examples, they can be combined to form character strings. We created as separate data items, and, as we've seen in several form of conversion in Java. Individual character strings. We created a Scanner object using the new operator. Java is a relatively new programming language compared to many others. The Java
concatenated with the initial string. The programmer is responsible for the accuracy and reliability of a program executes. Answers to Self-Review
Questions PP 3.3 Write an application that creates and prints a random phone number of the form XXX-XXXX. This table shows some examples: Operation Result 17 % 4 1 -20 % 3 -2 10 % -5 0 3 % 8 3 As you might expect, if either or both operands to any numeric operator are floating point values, the result is a floating point value.
 These steps aren't purely linear. We could show the numeric address, but the actual address value is irrelevant—what's important is that the variable refers to a particular object. K E Y CO NCEPT Constants hold a particular value for the duration of their existence. We mentioned earlier that an object is a fundamental element in a program. 1
Java Programming Language useless one. The java.swing package? K E Y CO NCEPT Sometimes you can capitalize on the fact that an operator is short-circuited. Mutation #2: CHANGE IS INEVITABLE, EXCEPT FROM VENDING MACHINES. // Assumes a positive discriminant. Read integer values that represent the number of quarters, dimes,
nickels, and pennies. num1: num2)); As we've seen, the conditional operator is occasionally helpful. String format (double number formatted according to the current pattern. change main to man f. PP 2.11 Write an application that prompts for and reads the numerator and denominator of a fraction and reads the number formatted according to the current pattern.
language. Another form of the import declaration uses an asterisk (*) to indicate that any class inside the package might be used in the program. Likewise, if the left operand is. The truth table in Figure 4.5 displays all of the possibilities. The
System class is part of the java.lang package as well. The lines of a program should be divided in logical places, and certain lines should be indented and aligned so that the program's underlying structure is clear. Let's carefully examine the idea of creating an object. It is often helpful to give a constant value a name, such as MAX_OCCUPANCY,
System.out.println("hello"); // prints hello System.out.println("test"); // change this later The first comment paraphrases the obvious purpose of the line and does not add any value to the statement. You should adhere to a set of guidelines that establishes the way you format and document your programs. 4.2 The if Statement We've used a basic is
statement in earlier examples in this chapter. EX 3.12 Write a declaration for an enumerated type that represents the days of the week. 4 continued public class Roses { //---
language. 

2 Define the types of data conversions and the mechanisms for accomplishing them. The difference between Java bytecode is not tied to any particular processor type. K E Y CO NCEPT Many different development environments exist to help you create and modify Java programs.
The last example in the list above contains no characters at all. There is no limit to the number of values that you can list for an enumerated type. Examples of basic software tools include an editor, a compiler, and an
interpreter. For each primitive type in Java there exists a corresponding wrapper class in the Java class library. In either case, the final sentence about age being a state of mind is printed. This is a form of assignment conversion, which was discussed in Chapter 2 It's also interesting to note that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a method called random that the Math class contains a m
returns a random floating point value in the range 0.0 to 1.0. Therefore, this method, as described in the previous section. Like variables that hold primitive types, a variable that refers to an object must be declared. A computer would have a difficult time trying to
determine which meaning was intended. hook&ladder EX 1.3 Why are the following valid Java identifiers not considered good identifiers? Classes can be created from other classes by using inheritance. The semantics of a program shown in Listing
3.2 produces several random numbers in various ranges. K EY C ONC EPT Syntax rules dictate the form of a program. Note that even though a float value supports very large (and very small) numbers, it has only seven significant digits. The program in Listing 1.1 prints two sentences to the screen. Exercises EX 2.1 Explain the following
programming statement in terms of objects and the services they provide. For example, the following line of code prints an ID number and a name: System.out.printf("ID: %5d\tName: %s", id, name); 3. Therefore, multiple values can be put on the same line of input or can be separated over multiple lines, as appropriate for the situation. PARTIAL
 SCREEN SHOTS MAY BE VIEWED IN FULL WITHIN THE SOFTWARE VERSION SPECIFIED. For example, if we attempt to divide by zero, the program will "crash" and halt execution at that point. It is part of the Java standard class library that can be found in any Java development environment. //--
 static void main(String[] args) { String message; Scanner scan = new Scanner(System.in); System.out.println("Enter a line of text:"); message = scan.nextLine(); System.out.println("You entered: "Set your laser printer on stun!" L I ST I N G 2 .9
identifier is a letter followed by zero or more letters and digits. String substring (int offset, int endIndex) Returns a new string that is a subset of this string starting at index offset and extending through endIndex-1. IN NO EVENT SHALL MICROSOFT AND/OR ITS RESPECTIVE SUPPLIERS BE LIABLE FOR ANY SPECIAL, INDIRECT OR
CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF INFORMATION AVAILABLE FROM THE SERVICES
constructor A special method that has the same name as the class and is called when a object is created to set up the object initially. Factorial b. - Joe Preface Welcome to Java Foundations. Various Scanner methods such as nextInt and nextDouble are provided to read data of particular types. We then lay the groundwork for software development
on a larger scale, exploring the foundations of problem solving, the activities involved in software development, and the principles of object-oriented programming. 5. When executed, the expression on the right-hand side of the assignment operator (=) is evaluated, and the result is stored in the memory location indicated by the variable on the left-
hand side. For instance, the fact that an identifier cannot begin with a digit is a syntax rule. If it's not, the result will not be a valid number, which Java represents as NAN, which stands for Not A Number. SR 3.4 Write a declaration for a String variable called author and initialize it to the string "Fred Brooks". Requirements are a clear expression of
the problem to be solved. Originally, programs were entered into the computer by using switches or some similarly tedious method. java.rmi Create programs that can be distributed across multiple computers; RMI stands for Remote Method Invocation. In Chapter 5 we discuss how such situations can be avoided. Therefore, no separate import
declaration is needed. For example, we use title case (uppercase for the first letter of each word) for class names and negative numbers. The entire conditional expression
returns the value of the first expression if the condition is true, and returns the value of the second expression if the condition is false. The methods of the Math class return values, which can be used in expression if the condition is false. The methods of the Math class return values, which can be used in expression if the condition is false. The methods of the Math class return values, which can be used in expression if the condition is false.
converted. Let's look at a few more examples of basic if statements. In particular, any proper software development effort consists of four basic development examples of basic if statements. 3.2 The String Class Let's examine the String class in more detail. SR 2.10 What is operator precedence? Several character sets have been
proposed, but only a few have been used regularly over the years. Print both the site name and the URL. a + (b - c) * d - e m. Requirements often address user interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues such as output format, screen layouts, and graphical interface issues as output format.
request it, the object will print a character string to the screen. These languages are called fourth-generations of computer programming: machine, assembly, and high-level languages, enumerated type. A Java data type in which all values of the type are explicitly listed.
Creating objects using the new operator is discussed further in the next chapter. The hardware is essentially useless without instructions to tell it what to do. Recall that the example programs that use the Scanner class in Chapter 2 include an import declaration like this one: import java.util.Scanner; 3. The DecimalFormat Class Unlike the
NumberFormat class, the DecimalFormat class, the DecimalFormat class is instantiated in the traditional way using the new operator. To be more precise, the identifier out is an object variable that is stored in the System class. 33 34 C H APTE R 2 Data and Expressions 2.1 Character Strings In Chapter 1 we discussed the basic structure of a Java program, including the
use of comments, identifiers, and white space, using the Lincoln program as an example. These words are exercised in the program shown in Listing 3.1 on page 82. The ! operator is unary, taking only one boolean operand. Changing the state of the object through one reference changes it for
the other, because there is actually only one object. Chapter 18 (Searching and Sorting) discusses the linear and binary search algorithms for several sorts: selection sort, insertion sort, bubble sort, and merge sort. That program has to be translated into a form that the computer can execute. Thus we say that a
String object is immutable. In previous editions, we had established the following flow when discussing collections: Explore the collection conceptually. 2 Variables and Assignment L I STING 2. Java uses the Unicode character set. static int parseInt (String str) Returns the int corresponding to the value stored in the specified string. That is, we
were able to invoke its methods. 5 The Math Class L I STING 3 .2 89 continued OU TPUT A random integer: 243057344 From 0 to 9: 4 A random float (between 0-1): 0.58384484 From 1 to 6: 3 3.5 The Math Class The Math Class provides a large number of basic mathematical functions that are
often helpful in making calculations. All widening conversions that go from an integer type, or from a floating point type, or from a floating point type, or from a floating point type, preserve the numeric value exactly. In fact, programmers A class library provides useful support often become dependent on the methods in a class library and begin when one
is developing programs. That is, it doesn't matter whether you write count++; or ++count; However, when such a form is written as a statement by itself, it is usually written in its postfix form. package A language-level organization mechanism for classes. Chapter 1 also included an overview of the various concepts involved in object-oriented
programming, such as objects, classes, and methods. For example, if the capacity of the theater change only one declaration, and all uses of MAX OCCUPANCY automatically reflect the change are to 535, then you have to change only one declaration, and all uses of MAX OCCUPANCY automatically reflect the change. Figure 4.3 shows a truth table that describes the ! operator. Internally, each value in an
enumerated type is stored as an integer, which is referred to as its ordinal value.
floating point value called sum is divided by an integer value called count, the value of count is promoted to a floating point value automatically, before the division takes place when a number is concatenated with a string. case-sensitive Making a distinction
between uppercase and lowercase letters. Objects usually represent more interesting or complex entities. The compiler ignores extra white space; therefore, it doesn't affect execution. Identifier names should be descriptive and readable. FROM 891 Update 896 25.6 Deleting Data and Database Tables 897 Deleting Data and Database Tables 897 Deleting Database Tables 898 Deleting Database Database Database Database Database Database Database Database Da
898 Appendix A Glossary 903 Appendix B Number Systems 937 Place Value 938 Bases Higher Than 10 939 Conversions 943 Appendix E Java Modifiers 955 959 Java Visibility Modifiers 960 A Visibility Example 960 Other Java
Modifiers 961 Appendix F JavaFX Graphics 963 Coordinate Systems 964 Representing Colors 964 Basic Shapes 965 Arcs970 CO N T E N T S Images974 Fonts976 Graphic Transformations 979 Translation979 Scaling980 Rotation981 Shearing982 Polygons and Polylines Appendix G JavaFX Scene Builder 982 987 Hello Moon 988 Handling Events in
JavaFX Scene Builder 993 Appendix H Regular Expressions 997 Appendix H Regular Express
 The HashMap Class The IdentityHashMap Class I.6 The WeakHashMap Class I.011 1013 1013 1014 1015 LinkedHashMap I last Cover: Liudmila Habrus/123RF Chapter 1 page 2: Reference: Java is a relatively new programming language compared to many others.
Interactive programs that read user input are discussed later in this chapter. F IGURE 3.5 Some methods of the NumberFormat class The formatter object and returns a String that contains the number formatted in the appropriate manner. The Scanner constructor accepts a parameter that indicates the source
of the input. After all, fruit flies like a banana. Taking white space to the other extreme, we could write almost every word and symbol on a different line with varying amounts of spaces. The concatenated string is passed to println and printed. If there is a second asterisk following the /* at the beginning of a comment, the content of the comment can
be used to automatically generate external documentation about your program by using a tool called javadoc. K EY C ONC EPT Enumerated types are type-safe, ensuring that invalid values will not be used. Let's consider these two options. Once the type is defined, a variable can be declared of that type: Season time; The variable time is now
restricted in the values it can take on. The fact that braces are used to begin and end classes and methods is also a syntax rule. A software design indicates how a program will accomplish its requirements. EX 3.4 What output is produced by the following code fragment? If an initial value is not specified for a variable, the value is undefined. Let's
                                                                                                                                    --public static void main(String[] args) { int radius; double area, circumference; Scanner scan = new Scanner(System.in); System.out.print("Enter the circle's radius: "); radius = scan.nextInt(); area = Math.PI * Math.pow(radius, 2); circumference = 2 *
Math.PI * radius; // Round the output to three decimal places DecimalFormat("Ithe circle's area: " + fmt.format(circumference: " + fmt.format(circumference:
31.416 The printf Method In addition to print and println, the System class has another output method called printf, which allows the user to print a formatted string containing data values. For now, let's explore the use of string literals further. Furthermore, this book is consistent with any recent versions of Java, through Java 11. ASCII was extended
to use 8 bits per character, and the number of characters in the set doubled to 256. What should be changed later? This process is pictured in Figure 1.4. The Java compiler translates Java source to
machine language code. The equivalent assembly language code is somewhat readable, but it is more verbose and less intuitive. White Space All Java programs use white space to separate the words and symbols used in a program. The code in Listing 1.2, the Lincoln 2 program, is formatted quite differently from Lincoln but prints the same message.
Strong emphasis is put on the proper use of inheritance and its role in software design. We say they are uninitialized, which can be depicted as follows: num - name - As we pointed out in Chapter 2, it is always important to be certain that a variable is initialized before using it. Java digits include the digits 0 through 9. It is called a runtime error and
causes the program to terminate abnormally. The program Echo, shown in Listing 2.8, simply reads a line of text typed by the user, stores it in a variable that holds a character string, and then echoes it back to the screen. The 49 50 C H APTE R 2

Data and Expressions extended ASCII contains many accented and diacritical characters used in
languages other than English. The term high-level refers to the fact that the programming statements are expressed in a way that is far removed from the machine language that is ultimately executed. The phrase white space refers to the fact that on a white sheet of paper with black printing, the space between the words and symbols is white. For
example, taking white space to one extreme, we could put as many words as possible on each line. We use the Java language in this text to demonstrate various programming concepts and techniques. What is software? SR 1.5 Which of the following are not valid Java identifiers? In previous examples, we've used the println method many times.
 --// Prints the number of keys on a piano. Answers to Self-Review Questions SRA 2.6 A variable declaration establishes the name of a variable and the type of data that it can contain. Summary of Terms Summary of
Key Concepts The new operator returns a reference to a newly created object. Then that string is concatenated with the second number (45), creating an even larger string, which gets printed. Self-Review Questions SR 1.1 What is hardware? The words marked with an asterisk abstract default goto* package this assert do if private throw boolean
double implements protected throws break else import public transient byte enum instanceof return true case extends int short try catch false interface static void char final long strictfp volatile class finally native super while const* float new switch continue for null synchronized F IGURE 1.1 Java reserved words 7 8 C H APTE R 1 Introduction
are reserved for possible future use in later versions of the language but currently have no meaning in Java. many—perhaps hundreds—of machine language instructions. When a variable is referenced, the value currently stored in it is used. The purpose and meaning of literal values such as 427 are often confusing to someone reading the code. 107
108 C H APTE R 3 Using Classes and Objects SRA 3.4 The following declaration creates a String variable called author and initializes it. The second comment is ambiguous. In Chapter 2 we also used the Scanner class, which represents an object that allows us to read input from the keyboard or a file. 2 Program Development Java source code
Java bytecode Java compiler Java interpreter Bytecode compiler Machine code F IGU RE 1.4 The Java translation and execution process portable from one machine type to another. In the following assignment statement, the current value of the variable count is added to the current value of the variable total, and the result is stored in the variable
sum: sum = count + total; The original value contained in sum before this assignment is overwritten by the calculated value. When is later? The getCurrencyInstance method returns a formatter for monetary values, and the getPercentInstance method returns a formatter for monetary values.
integer data types in Iava? A program is a series of instructions that the hardware executes one after another. The rest of the program is a class definition. The two lines of code in the main method invoke another method called println (pronounced print line).
problem solution is breaking it down into manageable pieces. We can use a software object to represent an employee in a company, for instance, white space. The space, tab, and newline characters used to separate words and symbols in a program. Then write a list of expressions using the nextInt method that generates random numbers in the
```

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following specified ranges, including the end points. Java is a high-level language, as are Ada, C++, Smalltalk, and many others. generator.nextInt(8) + 1 c. However, even with 256 characters, the ASCII character set cannot represent the world's alphabets, especially given the various Asian alphabets and their many thousands of ideograms. To
handle this kind of situation, we can add an else clause to an if statement, making it an if-else statement. The act of creating an object using the new operator is called instantiation. 2 The if Statement In the Wages program, if an employee works over 40 hours in a week, the payment amount takes into account the overtime hours. For example, a
single machine language instruction might copy a value into a register or compare a value to zero. We describe these later also. The name System.out is the way we designate the object through which we invoked the println method. Java does not have a built-in operator for raising a value to an exponent. Therefore, you should always be careful when
abbreviating words. Suppose we have two integer variables—num1, initialized to 5, and num2, initialized to 12: num1 5 num2 12 In the following assignment statement, a copy of the value that is stored in num1 is stored in num1 is stored in num1.
and relational operations. Then, even though multiplication and division are at the same level of precedence and usually would be evaluated left to right, the division is performed first because of the outer parentheses. The program can no longer invoke its methods or use its K E Y CO NCEPT variables. If we simply put it in a string("""), the compiler
gets confused because it thinks the second quotation character is the end of the string and doesn't know what to do with the third one. Java enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value other than one of the enumerated types are considered to be type-safe, which means that any attempt to use a value of the enumerated types are considered to be type-safe, which means that any attempt to use a value of the enumerated types are considered to be type-safe, which means that any attempt to use a value of the enumerated types are considered to be type-safe, and the type-safe type at the enumerated type at the enumerat
println method is a service provided by the System.out object, which represents the standard output stream. In Java, if you precede a declaration with the reserved word final, the identifier is made a constant. The syntax might be technically correct, but you may be attempting to do K E Y CO NCEPT something that the language doesn't semantically
 allow. 97 98 C H APTE R 3 Using Classes and Objects The values are accessed through the name of the type—for example, time = Season.spring; Enumerated types can be quite helpful in situations in which you have a relatively small number of distinct values that a variable can assume. A solution to any problem can rarely be expressed as one big
task. forgetting a semicolon at the end of a programming statement d. Therefore, any class in the java.lang package, such as System and String consisting of this string concatenated with str. change Test to test b. However, the program generally runs
more slowly because the translation process occurs during each execution. For example, the following declaration defines an enumerated type called Season whose possible values are winter, spring, summer, and fall. For example, we might create a hierarchy of classes that represent various types of accounts. The arithmetic operators generally
follow the same rules you learned in algebra. We explore that relationship in more detail at the appropriate point in the text. The way a programmer uses white space is important, because it can be used to emphasize parts of the code and can make a programmer uses white space is important, because it can be used to emphasize parts of the code and can make a programmer uses white space is important, because it can be used to emphasize parts of the code and can make a programmer uses white space is important, because it can be used to emphasize parts of the code and can make a programmer uses white space is important, because it can be used to emphasize parts of the code and can make a programmer uses white space is important, because it can be used to emphasize parts of the code and can make a programmer uses white space is important to do so, despite the fact that the poem is
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xxvi CONTENTS SELECT ... SR 3.16 Write a declaration for a double variable called result and initialize it to 5 raised to the power 2.5. SR 3.17 What are the steps to output a floating point value as a percentage using Java's formatting classes? SR 3.2 What is a null reference? ALL SUCH DOCUMENTS AND RELATED GRAPHICS ARE PROVIDED "AS
IS" WITHOUT WARRANTY OF ANY KIND. integrated development environment A set of software tools used to create, modify, and test a program. Inheritance is used appropriately in the design of the various types of lists, which are implemented using both array-based and linked representations. A high-level language insulates programmers from
needing to know the underlying machine language for the processor on which they are working. fResult = val1 / num4; f. If the cast had not been included, the operation would have performed integer division and truncated the answer before assigning it to result. 3 Packages Package Provides support to java. beans Define software components that
can be easily combined into applications. Testing cannot guarantee that there aren't still problems yet to be discovered, but it can raise our confidence that we have a viable solution. For instance, to simulate the roll 3. Semantics dictate the meaning of the program statements. Our emphasis in this chapter is understanding the important concepts
more than getting mired in heavy math or formality. Originally, the two references referred to different objects. This type of comment begins with a double slash (//) and continues to the end of the line. That is, the definition of one class can be based on another class that already exists. An if-else statement is used to determine whether the number of
hours entered by the user is greater than 40. 6 Reading Input Data Unless specified otherwise, a Scanner object assumes that whitespace characters (space characters, tabs, and new lines) are used to separate the elements of the input, called tokens, from each other. A linked implementation of a binary search tree is examined, followed by a
discussion of how the balance in the tree nodes is key to its performance. Note that even though we've declared a String object actually exists yet. Then write a statement that uses that object to print the value of the result, properly formatted. The behaviors of an object are the activities associated with the object. Today
most programmers use a high-level language to write software. It is now the dominant approach used in commercial software development. The declarations of object variables are similar in structure to the declarations of primitive variables. Java.math Perform calculations with arbitrarily high precision. 46 C H APTE R 2 Data and Expressions
Assignment Statement variable 1) expression is evaluated 2) result is assigned to variable height = height + gap; assignment operator Constants Sometimes we use data that are constant throughout a program. 1 The Java Programming Language serve just as well. In fact, only a small portion of the binary machine code to add two numbers
together is shown in Figure 1.2. The complete machine language code for this particular expression is over 400 bits long. To define a method containits attributes, and a set of behaviors, ing programming statements that will update the account balance
defined by its methods. Include the dashes in the output. static double num, which is the smallest whole number greater than or equal to num. Supplements The following student resources are available for this book: • Source code for all programs presented in the book • VideoNotes that explore select topics
from the book Resources can be accessed at www.pearson.com/lewis The following instructor resources can be found at Pearson Education's Instructor Resource Center: • Solutions for select exercises and programming projects in the book • PowerPoint slides for the presentation of the book content • Test bank To obtain access, please visit
www.pearsonhighered.com/irc or contact your local Pearson Education sales representative. Comments are the only language feature that allows programmers to compose and communicate their thoughts independent of the code. Hardware is tangible, whereas software is intangible. When it is important, we point out deprecated elements and
discuss the preferred alternatives. The Conditional Operator The Java conditional operator is similar to an if-else statement in some ways. System.out.println(title.toUpperCase()); SRA 3.6 The following declaration creates a String object and sets it equal to the first 10 characters of the String called description. Testing and debugging are now covered
in this chapter as well. - John To my wonderful wife Susan, and our children, Grace, Anthony, Adam, Lily, EJ, and Peter IV. The Scanner class provides methods for reading input of various types from various sources.
/// Demonstrates the difference between the addition and string // concatenation operators. Design issues related to polymorphism are examined as well. Fix the previous error each time, before you introduce a new one. Conversion via promotion occurs automatically when certain operators need to modify their operands in order to perform the
 operation. Discuss the concept of an iterator object, and use one to read a text file. In this case, when the value 10 is assignment: sides 7 sides 10 45 When a reference is made to a variable, such as when it is printed, the value of the variable
is not changed. 1 Boolean Expressions a !a false true true false F IGU RE 4.3 Truth table describing the logical NOT operator A logical operation can be described by a truth table that lists all possible combinations of values for the variables involved in an expression. All expressions are evaluated according to an operator precedence hierarchy
that establishes the rules that govern the order in which operations are evaluated. SRA 3.3 Two references are aliases of each other if they refer to the same object. 6 Some methods of the DecimalFormat class that represents the pattern that will guide the formatting process. It provides the ability to create graphics, communicate over networks
and interact with databases, among many other features. That leads to exploring AVL and red/black implementations of binary search trees. Chapter 20: Text: Adel'son-Vel'skii and Landis developed a method called AVL trees that is a variation on this theme. Chapter 20: Text: Adel'son-Vel'skii and Landis developed a method called AVL trees that is a variation on this theme.
program and the use of expressions to perform calculations. The assembly language and machine language in this example are specific to a Sparc processor. Nygaard, Kristen, Myhrhaug, Bjørn, and Dahl, Ole-Johan. size size is expressions to perform calculations. The assembly language and machine language in this example are specific to a Sparc processor. Nygaard, Kristen, Myhrhaug, Bjørn, and Dahl, Ole-Johan. size size is expressions to perform calculations. The assembly language and machine language in this example are specific to a Sparc processor.
 following statements are executed? For example, the if portion of an if-else statement could be a block, or the else portion could be a block (as we saw in the Guessing program), or both parts could be block statements, as shown in the following example: if (boxes != warehouse.getCount()) { System.out.println("Inventory and warehouse do NOT
match."); System.out.println("Beginning inventory process again!"); boxes = 0; } 123 124 C H APTE R 4 Conditionals and Loops else { System.out.println("Inventory and warehouse MATCH."); warehouse object
(whatever that is). Programming Projects PP 3.1 Write an application that prompts for and reads the user's first name and last name (separately). Test the solution and fix any problems that exist. For example, to invoke the length method defined in the String class, we can use the dot operator on the name reference variable: count = name.length()
                                                                                                                                                                                                                                                  -public static void main(String[] args) { int sides = 7; // declaration with initialization System.out.println("A heptagon has " + sides + " sides."); sides = 10; // assignment
The length method does not take any parameters, but the parentheses are still necessary to indicate that a method is being invoked. //---
statement System.out.println("A decagon has " + sides + " sides."); } OU T PU T A heptagon has " + sides + " sides."); } OU T PU T A heptagon has " + sides + " sides."); } OU T PU T A heptagon has " + sides + " sides.");
develop good commenting practices and follow them habitually. To develop a good solution, we must thoroughly understand the problem domain. For example, suppose you charged a $23 item to your credit card, but when you received the bill, the item was listed at $230. discriminant = Math.pow(b, 2) - (4 * a * c); root1 = ((-1 * b) + (-1 * b) +
Math.sqrt(discriminant)) / (2 * a); root2 = ((-1 * b) - Math.sqrt(discriminant)) / (2 * a); System.out.println("Root #1: " + root1); System.out.println("Root #2: " + root2); } 91 92 C H APTE R 3 Using Classes and Objects L I ST I N G 3 .4 continued OU T PU T Enter the coefficient of x squared: 3 Enter the coefficient of x: 8 Enter the constant: 4 Root
well in the future. The value of the boolean variable done is either true or false, and the NOT operator reverses that value. 4 Expressions Any arithmetic operators at the same level of precedence are performed from left to right. Chapter 8 (Inheritance) covers class derivations and associated concepts such as class hierarchies, overriding, and
visibility. Here is an example: Integer ageObj = new Integer (40); K E Y CO NCEPT A wrapper class allows a primitive value to be managed as an object. token An element in an input stream. Consider the following if statement: if (!done && (count > MAX)) System.out.println("Completed."); Under what conditions would the println statement be
executed? That's better than using a simple character or String variable to represent the grade, which could take on any value. iResult = (int) (val1 / num4); l. In addition to fundamental development tools, jGRASP contains tools that graphically display program elements. How does it affect program execution? However, a computer can do millions of
these instructions in All programs must be translated into a a second, and therefore, many simple commands can be executed particular CPU's machine language in quickly to accomplish complex tasks. We've already discussed several Java syntax rules. John Lewis, Villanova University, Virginia Tech Peter DePasquale, College of New Jersey Joe
Chase, Virginia Tech © 2017 | Pearson Format On-line Supplement ISBN-13: 9780134296401 Availability © 1996-2014, Amazon.com, Inc. Self-Review Questions object-oriented programm. The classes of the Java standard class library are also
SRA 2.10 Operator precedence is the set of rules that dictates the order in which operators are evaluated in an expression. Testing is the act of ensuring that a program will solve the targeted problem, given all of the constraints under which it must perform. Class definition An element in a Java program. Topics include bounds checking, initializer
lists, command-line arguments, variable-length parameter lists, and multidimensional arrays. Therefore, we say the arithmetic operators have a left-to-right association. The first few lines of the program are comments, which start with the // symbols and continue to the end of the line. It can be downloaded from www.jgrasp.org. total + 1: total * 2; In
many ways, the ?: operator serves as an abbreviated if-else statement. 0 to 10 b. Integers and Floating Points Java has two basic kinds of numeric values: integers, which have no fractional part, and floating points, which do. It has been predefined and set up for us as part of the Java standard class library. Information is more likely to be lost in a
narrowing conversion, which is why narrowing conversions are considered less safe than widening conversions. Note the difference between a digit as a number (or part of a string) and a digit as a number (or part of a larger number). Figure 2.2 summarizes the numeric primitive types. Remember, only one parameter is sent to a println statement
Consider the blueprint created by an architect when designing a house. Integer obj1; int num1 = 69; obj1 = num1; // automatically when needed. fResult = num3 / num4; e. Another example of an API is the Java Swing API, a set of classes that defines special
-// Calculates the final price of a purchased item using values // entered by the user. To be more
precise, the object's name is out and it is stored in the System class. But it means far more than that. The process generally used to translate and execute Java programs combines the use of a compiler and that of an interpreter. Each type of CPU has its own language. And even when the conditional operator is a viable alternative, you should use it
carefully, because it may be less readable than an if-else statement. The logical complement of a boolean value yields its opposite value. num1 is greater than num2, the variable larger. But in most cases, the act of designing the program should be far more interesting and creative
than the process of implementing the design in a particular programming language. Chapter 24 (Graphs) explores the concept of undirected and directed graphs and establishes important terminology. If we need to treat a floating point literal as a float, we append an F or f to the end of the value, as in 2.718F or 123.45f. P R E FAC E ix x PREFACE
Chapter 15 (Lists) covers three types of lists: ordered, unordered, and indexed. SR 3.12 Given a Random object called rand, what does the call rand.nextInt() return? From a user's point of view, anything that goes awry when interacting with a machine can be called a computer error. This text is about writing well-designed software. It also specifies
the relationships among the classes, java.lang General support; it is automatically imported into all Java programs. Zero... For example, every time you wanted to refer to the Scanner class defined in the java.util package, you could write java.util. Scanner. It explores the basic issues regarding the management of linked lists, and then defines an
alternative implementation of a stack (introduced in Chapter 12) using an underlying linked data structure. immutable An object whose data (state) cannot be modified once it is created. In Chapter 5 we use the Scanner class to read input from a data file and modify the delimiters it uses to parse the data. object A fundamental entity in a Java
program that represents something and provides services related to it. The first step, coming to understand the problem, may sound obvious, but a lack of attention to this step has been the cause of many misguided software development efforts. 2 The if Statement 119 if (generator.nextInt(CHANCE) == 0) System.out.println("You are a randomly not only in the cause of many misguided software development efforts. 2 The if Statement 119 if (generator.nextInt(CHANCE) == 0) System.out.println("You are a randomly not only in the cause of many misguided software development efforts. 2 The if Statement 119 if (generator.nextInt(CHANCE) == 0) System.out.println("You are a randomly not only in the cause of many misguided software development efforts. 2 The if Statement 119 if (generator.nextInt(CHANCE) == 0) System.out.println("You are a randomly not only in the cause of many misguided software development efforts. 2 The if Statement 119 if (generator.nextInt(CHANCE) == 0) System.out.println("You are a randomly not only in the cause of many misguided software development efforts. 2 The if Statement 119 if (generator.nextInt(CHANCE) == 0) System.out.println("You are a randomly not only in the cause of many misguided software development efforts. 2 The if Statement 119 if (generator.nextInt(CHANCE) == 0) System.out.println("You are a randomly not only in the cause of many misguided software development efforts. 2 The if Statement efforts is a statement of the cause of many misguided software development efforts. 3 The if Statement efforts is a statement efforts in the cause of many misguided software development efforts. 3 The if Statement efforts is a statement efforts in the cause of many misguided software development efforts in the cause of many misguided software efforts in the cause o
selected winner!"); The odds of this code picking a winner are based on the Value of the CHANCE constant. syntax The rules of a language that dictate how vocabulary elements of the language that dictate how vocabulary elements elements elements of the language that dictate how vocabulary elements el
development environment will contain certain key tools, such as a Java compiler and interpreter. Let's explore these issues in more detail. After an object has been instantiated, we use the dot operator to access its methods.
Objects sure it refers to a valid object prior to using it. variable A name for a location in memory used to hold a data value. Remember that each state usually affects the results. All the methods in the Math class are static methods, which means they we can invoke them through the name of the class in which they are
defined, without having to instantiate an object of the class first. However, in order to execute, a program must be expressed in a particular computer's machine language, which consists of a series of bits that is basically unreadable by humans. PP 2.9 Write an application that prompts for and reads a double value representing a monetary amount.
We can simply use it. iResu lt = num2 % num3; p. length le
how to do it), implementation (writing the solution in source code), and testing (validating the implementation). The order of operator evaluation is the same if the operands are variables or any other source of data. The uppercase are all different identifiers. Here are some examples of boolean variable declarations in Java: boolean flag = true; boolean
 From To byte short, int, long, float, or double short int, long, float, or double char int, long, float, or double int long, float, or double for many years, essentially as long as high-level programming languages have been used. SRA 2.4
expression tree, such as the one in Figure 2.3. The operators are executed from the bottom up, creating values that are used in the rest of the expression. A wrapper class represents a particular primitive type. The print method is similar to println, but it does not advance to the next line when completed. For that reason, we can't run a program
specifically written for a Sun Workstation, with its Sparc processor, on a Dell PC, with its Intel processor. String toLowerCase () Returns a new string identical to this string except all uppercase letters are converted to their lowercase equivalent. Another compiler could transarchitecture-neutral representation of late the bytecode into a particular
program does but are included to make the program easier to understand by humans. The first approach we choose in seeking a solution may not be the best one. Chapter 20 (Binary Search tree. 3 An expression tree 53 54 C H APTE R 2 Data and
 Expressions Precedence Level Operator 1 + unary plus - unary minus * multiplication / division % remainder + addition - subtraction + string concatenation of Information." 1962. All conditionals and loops are based on boolean
 expressions, which use equality operators, relational operators, relational operators, and logical operators to make decisions. K EY C ONC EPT Appropriate use of white space makes a program easier to read and understand. Two... A civil engineer would never consider building a bridge without designing it first. The print and println Methods In the Lincoln program in
Chapter 1, we invoked the println method as follows: System.out.println("Whatever you are, be a good one."); This statement demonstrates the use of objects. Because string literal, delimited by double quotation characters, as we've seen in previous examples. A
common phrase used to describe this situation is "garbage out." You will encounter three kinds of errors as you develop programs: 🔳 compile-time error 18 C H APTE R 1 Introduction The compiler checks to make sure you are using the correct syntax. The result of an && operation is true if both
operands are true, but is false otherwise. When the method completes, control returns to the place in the calling method where the invocation was made, and processing continues from there. We can ask such questions using various operators, depending on the relationship. The following expression concatenates one character string and another,
producing one long string: "The only stupid question is " + "the one that's not asked." The program called Facts shown in Listing 2.2 contains several println statements. That is, some of the activities will overlap others. These operators include less than or equal to greater than greater than or equal to greater than greater than or equal to greater than or equal to greater than greater than or equal to greater than or equal to greater than greater than or equal to greater than or equal to greater than greater than or equal to greater than or equal to greater than or equal to greater than greater than or equal to greater than or equal to greater than or equal to greater than greater than or equal to greater th
to F IGU R E 4. The following program statement is improper syntax and would produce an error when attempting to compile: // The following statement will not compile System.out.println("The only stupid question is the one that's not asked."); When we want to print a string that is too long to fit on one line in a program, we can rely on string
concatenation to append one string to the end of another. 101 102 C H APTE R 3 Using Classes and Objects Autoboxing a program in one of many programming languages, such as Java, Ada, C, C++
C#, Pascal, and Smalltalk. If the addition is performed first, the result is 11; if the division operation is performed first, the result is 18. LOCATION OF VIDEONOTES IN THE TEXT VideoNote Chapter 2 Example using strings
and escape sequences, page 40 Review of primitive data and expressions, page 52 Example using the Scanner class, page 63 Chapter 3 Creating objects, page 77 Examples using while loops, page 138 Examples using for loops, page 155 Chapter 5
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432 Chapter 12 An overview of the Array-Stack implementation, page 552 Chapter 13 Using a stack to solve a maze, page 512 Chapter 14 An array-based queue implementation, page 552 Chapter 15 List categories, page 552 Chapter 17 Analyzing recursive algorithms, page 544 Chapter 18 Demonstration of a binary search, page 657 Chapter 19 Chapter 
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Illustration of depth-first and breadth-first traversals of a graph, page 855 xxxi Introduction C H A PTE R O B JE C TI V E S 🔳 Introduce the Java programming language. A pseudorandom number generator performs a complex calculation to create the illusion of randomness. You will recall that string literals are delineated using double quotation
marks, and that the String type is not a primitive data type in Java but a class name. result c. The important decisions should be made when establishing the requirements and creating the design. A Scanner object processes the input one token at a time, based on the methods used to read the data and the delimiters used to separate the input values
73 Using Classes and Objects C H A PTE R 🔳 🔳 O B JE C TI V E S 3 Discuss the creation of objects and the use of object reference variables. be correct. Games often use random numbers to simulate the roll of a die or the shuffle of a deck of cards. Self-Review Questions SR 3.1 What does the new operator accomplish? That person
might explain those directions in any one of several languages, such as English, Russian, or Italian. Development environments A software development environment is the set of tools used to create, test, and modify a program. Once a class has been defined, multiple objects can be created from that class. SR 3.19 How can we represent a primitive
value as an object? Reserved words are identifiers that have a special meaning in a programming language and can be used only in predefined ways. That is, there is one and only one interpretation for each statement. Some of these packages support highly specific programming techniques and do not come into play in the development of basic
programs. K E Y CO NCEPT A computer system consists of hardware and software that work in concert to help us solve problems. It is better to have no comment than to add a 1. EX 3.9 Write a single statement that computes and prints the absolute value of total. (Note that you may see a different amount of indentation when you run this program-
developing software. For many traditional compilers, the source code is translated directly into a particular machine language. It establishes the kind of data an object of that type will hold and defines the methods that represent the behavior of such objects. 27 28 C H APTE R 1 Introduction Exercises EX 1.1 Give examples of the two types of Java-
comments, and explain the differences between them. Arithmetic Operators The usual arithmetic operations are defined for both integer and floating point numeric types, including addition (+), subtraction (-), multiplication (*), and division (/). It is much easier for programmers to deal with words than with binary digits. In this example, the
parameter to the constructor is a string K EY C ONC EPT literal that specifies the characters that the string object will hold. These statements enable us to decide which statement to execute next. static double pow (double num, double pow er) Returns the value num raised to the specified power. The machine language is basically unreadable and
much longer. In the ASCII and Unicode ordering, the digit characters '0' through '9' are continuous (no other characters intervene) and in order. 2.2 Variables and Assignment Most of the information we manage in a program is represented by variables. In this case, the software compiles and executes without complaint, but it produces incorrect
results. K EY C ONC EPT All methods of the Math class are static, which means that they are invoked through the class name. A high-level language program must be translated into machine language before it can be run. For example, a logical error occurs when a value is calculated incorrectly or when a graphical button does not appear in the
correct place. Various classes of the Java standard class library are discussed throughout this book. It may contain other attributes, such as the name of the account owner. iResult = num2 % num4; EX 2.11 For each of the following expressions, indicate the order in which the operators will be evaluated by writing a number beneath each operator.
Describe how the Java standard class library is organized into packages. Accessed at Chapter 1 page 15: Excerpt: A research group at Auburn University has developed jGRASP, a free Java IDE that is included on the CD that accompanies this book. The accuracy of the requirements, for instance, should be tested by reviewing them with the client. The
try-catch statement is examined, as well as a discussion of exception propagation. 3 Primitive Data Types Decimal Integer Literal 0 1-9 0-9 L l An integer literal is composed of a series of digits followed by an optional suffix to indicate that it should be considered a long integer. Names appear quite regularly in Java programs. A character set assigns
a particular number to each character, so by definition the characters are in a particular order. 1970. Because the requested operation is undefined, the system simply abandons its attempt to continue processing your program. 19 20 C H APTE R 1 Introduction 1.4 Software Development Activities Given that the goal of software development is to
solve problems, it shouldn't surprise you that the activities involved in the previous section. K E Y CO NCEPT The Java standard class library is organized into packages. Explore the services provided by the Random and Math classes. System.out.println("He
thrusts his fists\tagainst" + " the postand still insists\the sees the \"ghost\""); EX 2.6 What value is contained in the integer variable size after the following statements are executed? If the person smokes, we calculate the cost using a particular formula; if not, we calculate it using another. Narrowing conversions can lose both numeric magnitude and
precision. 31 Data and Expressions CHAPTER Discuss the use of character strings, concatenation, and escape sequences. If count has the value zero, the left side of the && operation is false; therefore, the whole expression is false and the right side is not evaluated. Figure 1.2 shows equivalent expressions in a high-level language,
in assembly language, and in machine language. SRA 2.13 After executing the statement, diameter holds the value 20. 13 14 C H APTE R 1 Introduction errors Edit and save program Figure 1.3 shows a very basic
view of the program development process. It's not that you want to avoid aliases, you just want to be aware of the effect they have on the objects you manage. When a method is invoked, its statements are executed. MICROSOFT ® AND WINDOWS® ARE REGISTERED TRADEMARKS OF THE MICROSOFT CORPORATION IN THE U.S.A. AND OTHER
works the same as the integer assignment—a copy of the value of name1 is stored in name2. The following if statement causes the variable size to be set to zero if its current value is greater than or equal to the value in the constant MAX. The println method is part of the System.out object, which is part of the Java standard class library. The variables are to see the variable size to be set to zero if its current value in the constant MAX.
num1 and num2 still refer to different locations in memory, and both of those locations now contain the value 5: num1 5 num2 5 3. The following are examples of numeric variable declarations in Java: int answer = 42; byte smallNumber1, smallNumber2; long countedStars = 86827263927L; float ratio = 0.2363F; double delta = 453.523311903;
Characters Characters are another fundamental type of data used and managed on a computer. The authors of that code—we're just making use of them. Chapter 1 page 20: Reference: The programming language Simula, developed in the 1960s, had many characteristics that define the modern object-oriented
approach to software development. SRA 2.5 An escape sequence is a series of characters that the following characters should be treated in some special way. cause the operators are executed from left to right. The pattern %5d indicates that the corresponding numeric value (id) should be printed in a
field of five characters. As always, parentheses can be used to explicitly specify the order of evaluation. The logical OR. They differ in how much memory space is allocated for each and, therefore, in how large a number they can hold. The chapter
also explores the use of exceptions when dealing with input and output, and examines an example that writes a text file. Figure 4.2 lists and describes the logical operators. A declaration may also have an optional initialization, which gives the variable an initial value. Operator Description Example Result!
is true && logical AND a && b true if a and b are both true and false otherwise || logical OR a || b true if a or b or both are true and false otherwise F I G UR E 4. An object is defined by a class, which contains methods that define the operations on those objects (the services that they perform). If we attempt to solve a problem we don't completely
understand, we often end up solving the wrong problem or at least going off on improper tangents. They should be descriptive but not verbose. The println method prints the specified characters to the screen. Explore implementation options and efficiency issues. This situation is called a nested if. By giving the value a name, you help explain its role and efficiency issues.
in the program. They are in different locations, have different locations, have different furniture, and are inhabited by different people. Basic Assignment operator (=) to store the result of the Expression into the specified Identifier, usually a variable. The bytecode
might be transported across the Web before being executed by a Java interpreter that is part of a Web browser. However, completely specifying the package and class name every time it is needed quickly becomes tiring. depth = 20 - depth * 4; depth = depth / 5; EX 2.8 What value is contained in the integer variable length after the
following statements are executed? A compiler or development environment often comes with a class library. They test whether two values are equal or are not equal, respectively. SRA 3.14 A class (or static) method can be invoked through the name of the class that contains it, such as Math.abs. However, unlike the other wrapper classes, the Void
class cannot be instantiated. But what is the result? It discusses various implementation approaches and uses a binary tree to represent and evaluate an arithmetic expression. In the later chapters, the exploration of collections and data structures is modeled after the coverage in Java Software Structures, but has been reworked to flow cleanly from
the introductory material. 1 The Java Programming Language development are the cornerstone of this text. System.out.println("I gotta be me!"); EX 2.2 What output is produced by the following code fragment? The purpose of the length method of the String (the number of characters it and return the length method of the String (the number of characters it and return the length method of the String class is to determine and return the length of the string (the number of characters it and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the length method of the String class is to determine and return the string class is to de
contains). The type of result produced by arithmetic division depends on the types of the operands. Objects are more complex entities that usually contain primitive data that help define them. In these cases we need to "wrap" a primitive data that help define them. In these cases we need to "wrap" a primitive data that help define them. In these cases we need to "wrap" a primitive data that help define them.
important to collections. If the age is equal to or greater than the value of MINOR, the println statement is skipped. int nextInt (int num) Returns a random number in the range 0 to num-1. 85 86 C H APTE R 3 Using Classes and Objects Import java.util.Random; import java
K E Y CO NCEPT All classes of the java.lang package are automatically imported for every program. delimiter Characters used to separate one input token from another. a + b / c * d e. The escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence forces the output to a new line, and the \t escape sequence force forces the output to a new line, and the \t escape sequence force f
MAKE NO REPRESENTATIONS ABOUT THE SUITABILITY OF THE INFORMATION CONTAINED IN THE DOCUMENTS AND RELATED GRAPHICS PUBLISHED AS PART OF THE SERVICES FOR ANY PURPOSE. Because a byte does not have enough bits to represent the value 1000, some bits would be lost in the conversion, and the number
represented in the byte would not keep its original value. Therefore, the / operator performs integer division, and the fractional part of the result is truncated. SR 1.7 Name the four basic activities that are involved in the software development process. 8 Wrapper Classes Integer (int value) Constructor: creates a new Integer object storing the
  imported into any Java program. An interpreter interweaves the translation and execution activities. a - ((b - c) - d) k. SR 3.10 What does an import declaration accomplish? Instead, we request an object from one of its static methods that we invoke through the class name itself. Therefore, the expression on the We cannot assign a value of one type
right-hand side of an assignment statement must evaluate to a variable of an incompatible type. In this case, the division is performed before the addition, yielding a result of 18. This pattern is used in the CircleStats program, shown in Listing 3.5, which reads the radius of a circle from the user and computes the circle's area and
circumference. or its affiliates Table of contents: CoverPrefaceContentsChapter 1 Chapter 2 Chapter 3 Citation preview To my wife, Sharon, for everything. The following if statement prints a sentence only if the variables total and sum contain the same value. //----
                                                                                                                                                                                                                                                                                                                                                                                                                                - 2. garbage collection The process of
reclaiming memory space that can no longer be used by a program. You should avoid meaningless names such as a and x. SRA 2.14 After executing the statement; if (roster.expand(); else roster.addName(name); This example makes use of an if-else statement.
Demonstrates the use of an if statement. The values of the Scanner Class The Scanner class, which is part of the standard Java class library, provides convenient methods for reading input values of various types. We can shift the range as
 needed by adding or subtracting the proper amount. The example in Listing 4.1 reads the age of the user and then makes a decision about whether to print a particular sentence based on the age that is entered. Note that returns a boolean result
Objects in Java are created using the new operator. All related statements for conditionals and loops are discussed, including the enhanced version of the for loop. The quadratic formula is roots = -b { 2b2 - 4ac 2a Note that this program assumes that the discriminant (the value under the square root) is positive. For example, the Integer class contains
two constants, MIN_VALUE and MAX_VALUE, that hold the smallest and largest int values, respectively. a - b + c - d c. However, if two or more classes of the package will be used, the * notation is usually fine. //---
                                                                                                                                                                                                                                                                                                                                                             --public static void main(String[] args) { System.out.println("24 and 45 concatenated: " + 24 +
45); System.out.println("24 and 45 added: " + (24 + 45)); } OU TPUT 24 and 45 concatenated: 2445 24 and 45 concatenated: 2445 24 and 45 concatenated: 2445 24 and 45 added: " + (24 + 45)); } OU TPUT 24 and 45 concatenated: 2445 24 and 25 concatenated: 2445 24 and 245 24 an
program. The concepts of 2-3 trees, 2-4 trees, and general B-trees are examined and implementation options are discussed. SRA 3.10 An import declaration establishes the fact that a program uses a particular class, specifying the package that the class is a part of. remove the last quotation mark in the string e. The other wrapper classes have similar class, specifying the package that the class is a part of.
methods. Mutation #3: CHANGX IS INXVITABLX, XXCXPT FROM VXNDING MACHINXS. • A new Appendix F that discusses the rendering of graphics using JavaFX. SR 1.8 What are the primary concepts that support object-oriented programmers. Some of the core
object-oriented concepts are depicted in Figure 1.6. We don't expect you to understand these ideas fully at this point. You should always strive to make your programs as readable as possible. Each type of loop statement has unique characteristics that distinguish it from the others. The use of String and args does not come into play in this particular
program. Each digit does not have to be determined separately. float nextFloat () Returns a random number between 0.0 (inclusive) and 1.0 (exclusive). Java assumes that all integer literals are of type long, such as 45L. The pattern defined
by the string that is passed to the DecimalFormat constructor can get fairly elaborate. For instance, if we wanted the addition to be performed first in the previous example, we could write the expression as follows: K EY C ONC EPT Java follows: K 
expression. Consider the following example: if (code == 'R') if (height The Java API is huge and quite versatile. Prompt for and read two integer values and print the sum of each value raised to the third power. In the next chapter we discuss classes that help us format our output in various ways, including rounding a floating point value to a particular
number of decimal places. We begin with a discussion of boolean expressions, which form the basis of any decision. //-------/* This is one comment that spans several lines. The output is shown below the program listing. In this chapter, we use classes and objects to manipulate
                          produce random numbers, perform complex calculations, and format output. 3.7 Enumerated Types Java provides the ability to define an enumerated type, which can then be used as the type of a variable when it is declared. This chapter also introduces the enumerated type, which is a special kind of class in Java, and discusses
concept of a wrapper class. 79 80 C H APTE R 3 Using Classes and Objects All interaction with an object occurs through a reference variable, so we can use an object only if we have a reference to it. Use the following formulas, in which r represents the sphere's radius. The only restriction is that there must be a Java interpreter or a bytecode
compiler for each processor type on which the Java bytecode is to be executed. Each bank account object will keep track of its own balance. treated as part of the output. Essentially, the requirements establish the characteristics that make the program useful for the end
user. The Java standard class library is a group of packages that supports common programming tasks. That number is then concatenated with the string, producing a larger string that gets printed. The Random class? Chapter 9 (Polymorphism) explores the concept of binding and how it relates to polymorphism. 109 Conditionals and Loops C H A
PTE R O B JE C TI V E S Discuss the flow of control through a method. There is a third good reason to use constants. A reserved word cannot be used for any other purpose, such as naming a class or method. Note that each of // these lines is technically a separate comment. Chapter 10 (Exceptions) covers exception handling and the effects of
uncaught exceptions. Anything between the initiating slash-asterisk (/*) and the terminating asterisk-slash (*/) is part of the comment, including the invisible newline character that represents the end of a line. Because white space is ignored, we can write a program in many different ways. For example, instead of having graphics sections spread
throughout many chapters, the coverage of graphical user interfaces is accomplished in a well-organized chapter of its own. An exception to this rule can be made if the short name is actually descriptive, such as using x and y to represent (x, y) coordinates on a twodimensional grid. Therefore, in general, they should be avoided. Both NetBeans and
Eclipse are open source projects, which means that they are developed by a wide collection of programmers and are available free. Java provides the import declaration to simplify these references. For example, 83 84 C H APTE R 3 Using Classes and Objects we may refer to the Java Database API when we're talking about the set of classes that
helps us write programs that interact with a database. The Scanner class can also be used to parse a character string into separate pieces. graphical elements such as windows and buttons. Static methods are discussed further in Chapter 5. int length () Returns the number of
characters in this string. An object is marked for garbage collection only when there are no valid references to it. a + b / c / d d. A dodecagon has 12 sides. Both linked and array-based implementations are explored. The programmer does not have to worry about explicitly reclaiming memory that has become garbage. Expressions are combinations of
operators and operands used to perform a calculation. Narrowing conversions are more likely to lose information than widening conversions are. We might declare the following enumerated type: enum Grade {A, B, C, D, F} Any initialized variable that holds a Grade is guaranteed to have one of those valid grades. The identifiers RESULT and result
are both valid, but they should not be used together in a program because they differ only by case. Examples: 5 2594 4920328L The characters we can manage are defined by a character set, which is simply a list of characters we can manage are defined by a character set, which is simply a list of characters we can manage are defined by a character set, which is simply a list of characters in a particular order. The condition in this statement is count > 20. Appendix H explores how to use the Scanner class to
analyze its input using patterns called regular expressions. Design a solution. Explore the declaration and use of variables. These are still considered narrowing conversions, because the sign bit is incorporated into the new character value. expression A combination of one or more operators and operands. 111 112 C H APTE R 4 Conditionals
and Loops 4.1 Boolean Expressions The order in which statements are executed in a running program, it can be accomplished using a cast. Scanner useDelimiter (String pattern) Scanner useDelimiter (Pattern pattern) Sets the scanner's delimiting pattern. We
explore the String class and its methods in more detail in Chapter 3. Java was introduced to the public in 1995 and has gained tremendous popularity since. It should not be ambiguous or belabor the obvious. Once the object was created, we were able to use it for the various services it provides. If they do match, a different message is printed and the
Data and Expressions L I ST I N G 2 .8 continued public class Echo { //--
                                                                                                                                                                 ---// Reads a character string from the user and prints it. The println method prints the information sent to it and then moves to the beginning of the next line. The order in which the operations are performed makes a big difference.
Summary of Terms application programming interface (API) A set of related classes that supports a particular aspect of programming. Negation of a literal is considered a separate operation. 6 Formatting Output DecimalFormat (String pattern) Constructor: creates a new DecimalFormat object with the specified pattern. Although an identifier
can be of any length, you should choose your names carefully. We separate them in the Facts program to demonstrate the ability to concatenate a string and a number. In a classroom setting, students are generally provided the software requirements in the form of the problem assignment. x12345y e. Figure 3.7 shows the wrapper class that
corresponds to each primitive type. The changes made in this edition build on the strong pedagogy established by previous editions while updating crucial areas. For example, if the operands to the += operator are strings, then the assignment operator are strings, then the assignment operator are strings, then the assignment operator are strings.
imported into our programs? integer division Division in which the fractional portion of the result is discarded, used when both operands are integers. String nextLine() Returns all input remaining on the current line as a character string, narrowing conversion A conversion between one data type and another in which information may be lost. A
programmer must test the program thoroughly, comparing the expected results to those that actually occur. Because the logical NOT operator is unary, there are only two possible values for its one operand, which must be either true or false. Mouse events, keyboard events, and layout panes are also explored. char charAt (int index) Returns the
character at the specified index. It's as if all program files automatically contain the following declaration: import java, lang. *: 3.4 The Random Class The need for random numbers occurs frequently when one is writing software. The input could come from various sources, including data typed interactively by the user or data stored in a file. This
approach also allows an instructor, on a case-by-case basis, to simply introduce a collection without exploring implementation details if desired. The programming language Simula, developed in the 1960s, had many characteristics that define the modern object-oriented approach to software development. Thus a call to nextInt(20) will return a
random number in the range 0 to 19, inclusive. Often, requirements are expressed in a document called a functional specification. The GasMileage program, shown in Listing 2.9, reads the number of miles traveled as an integer, reads the number of fuel consumed as a double, and then computes the gas mileage. 6 Java narrowing
conversions 59 60 C H APTE R 2 Data and Expressions Conversion Techniques In Java, conversion conversion assignment conversion occurs when a value of one type is assignment to a variable of another type, during which the value is converted to the new type. "Simula, It
explores the implementation details of recursion and discusses the basic idea of analyzing recursive algorithms. fResult = (int) (val1 / num4); m. Therefore, it is functionally equivalent to the following statement, which we discussed in the previous section:
(such as count++ or count--), creating what is called the postfix form of the operator. There are four integer data types (byte, short, int, and long) and two floating point data types (float and double). However, an assembly language program cannot be executed directly on a computer. VideoNote Examples of various error types The second kind of
problem occurs during program execution. PP 1.7 Write an application that prints the following diamond shape. Finally, the multiplication is performed. A class defines a concept Multiple encapsulated objects can be created from one class Bank Account Balance: $5,257 Classes can be organized into inheritance hierarchies
system consists of hardware and software that work in concert to help us solve problems. java.sql Interact with databases; SQL stands for Structured Query Language. 1 Some methods of the String object referenced by the variable
num) static String tohexString (int num) static String tohexString (int num) static String tooctalString (int num) static String tohexString (int num) static String (int num) static String tohexString (int num) static String tohexString (int num) static String tohexString (int num) static String (int num) static String tohexString (int num) static String (int num)
meaning depending on the situation. If you leave the semicolon off of a statement, the compiler will get confused and issue an error. It might take four separate machine language instructions to add two numbers together and to store the K E Y CO NCEPT result. When defects are found, they must be traced back to the source of the problem in the
code and corrected. iResult = num3 % num2; q. For example, the parameter to the println method indicates what characters should be printed. Many other Java development environments are available as well. Chapter 3 (Using Classes and Objects) explores the use of predefined classes and the objects that can be created from them.
System.out.println(Math.sin(1.23)); SRA 3.16 The following declaration creates a double variable and initializes it to 5 raised to the power 2.5. double result = Math.pow(5, 2.5); SRA 3.17 To output a floating point value as a percentage, you first obtain a formatter object using a call to the static method getPercentInstance of the NumberFormat class
K E Y CO NCEPT In Java, the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println, we use parentheses to group the + operator is used In the second call to println the second call the second 
to operate at an even higher level than high-level languages. That result is then 2. By "state" we mean state of being—fundamental characteristics that currently define the object. Because the compilation process is more efficient than interpreting
high-level code directly. Fortunately, changes are relatively easy to make during the design stage. When a new value is assigned to it, the old one is overwritten and lost. vii viii PREFACE • Updated examples and discussions throughout the text. compiler A program that translates code in one language into equivalent code in another language. Too
often programming is thought of as writing code. The println method is a service that the System.out object performs for us. instantiation The process of creating a new object. A compiler is a program that translates code in one language into equivalent code in another language. We couldn't use A- or B+ as values, because they are not valid
identifiers (the characters '-' and '+' cannot be part of an identifier in Java). To get a random number in the range of 1 to 6, we can call nextInt(6) to get a value from 0 to 5, and then add 1. As we've already discussed, a literal is an explicit data value used in a program. Read the Fahrenheit temperature from the user. to Java to support the migration
NOT SPONSORED OR ENDORSED BY OR AFFILIATED WITH THE MICROSOFT CORPORATION. Because each bit can represent two different values. PP 2.2 Write an application that reads three integers and prints their average. An if statement consists of the reserved word if followed
by a boolean expression, followed by a statement. spelling a word wrong in the output e. A conversions and narrowing conversions are the specific characteristics of the object-oriented approach that help us solve those problems. For an object
variable, that means we must make 3. 2.5 Data Conversion Because Java is a strongly typed language, each data value is associated with a particular type. This awkward approach is illustrated by Lincoln2.java Java
Foundations // // Demonstrates a poorly formatted, though valid, program. The printf method was added to Java to support the migration of legacy systems. string literal Text enclosed by double quotation marks that represent a character string. Precedence, however, can be forced in an expression by using parentheses. reserved word An identifier
that has a special meaning in a program language and can be used only in predefined ways. SR 2.2 What is a string literal? When all references to an object are lost (perhaps by reassignment), that object can no longer contribute to the program. It is similar to an algebraic expression. The System.in object represents the standard input stream, which
by default is the keyboard. level 2 e. (For example, 1 hour, 28 minutes, and 42 seconds is equivalent to 5322 seconds.) PP 2.7 Create a version of the previous project that reverses the computation. Figure 2.6 lists the Java narrowing conversions. dividing by zero c. to think of them as part of the language. If the literal 2. Java letters include the 26
English alphabetic characters in both uppercase and lowercase, the $ and (underscore) characters from other languages.
as the identifier that defines the value. Self-Review Questions SR 2.1 What are primitive data? Therefore, the statement total += (sum - 12) / count; is equivalent to total = total + ((sum - 12) / count); Many similar assignment operators are defined in Java, including those that perform subtraction (-=), multiplication (*=), division (/=), and remainder
(%=). There are four integer data types and two floating point data types. Any A Java program must be syntactically error identified by the compiler is called a compiler in detail. Some include a debugger, which helps you find errors in a program. EX 1.6 Categorize each of the following situations as a compiler in the following situations as a compiler in the following situation in the followin
run-time error, or logical error: a. int compareTo (String str) Returns an integer indicating if this string is lexically before (a positive return value), the string str. Errors Several different kinds of problems can occur in software, particularly during program development. This
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book is designed to serve as the primary resource for a two- or three-term introductory course sequence, ranging from the most basic programming concepts to the design and implementation of complex data structures. Also note that because the cast operator has a higher precedence than the division operator, the cast operates on the value of total
not on the result of the division. Parentheses have a higher precedence than almost any other operator. K EY C ONC EPT A pseudorandom number generator performs a complex calculation to create the illusion of randomness. 1 Character Strings 35 Invoking a Method object parameter(s) System.out . println ( "Hello" ); method name The
System.out object also provides another service we can use: the print method. A narrowing conversion does the opposite. String literal cannot span multiple lines in a program. public class Test { public static void main(String[] args) { System.out.println("An Emergency Broadcast"); } } Programming Projects PP 1.2 Introduce
the following errors, one at a time, into the program from Project 1.1. Record any error messages that the compiler produces. Widening conversions are the safest because they usually do not lose information. Answers to Self-Review Questions SRA 2.1 Primitive data are basic values such as numbers or characters. The result of the
expression determines which statement is executed next. javafx.application Define a graphics-based application using the JavaFX framework. Some of those statement is executed next. javafx.application Define a graphics-based application using the JavaFX framework. Some of those statement is executed next. javafx.application Define a graphics the following
declaration allows all classes in the java.util package to be referenced in the program without qualifying each reference: import java.util.*; If only one class of a particular package will be used in a program, it is usually better to name the class specifically in the import declaration, because that provides more specific information to anyone reading the
code. The condition of the if statement calls getSize and compares the result to the constants. A software development comYou should adhere to a set of pany often has a programming style policy that it requires its guidelines that establishes the way
programmers to follow. SRA 1.8 The primary elements that support objects, classes, encapsulation, and inheritance. Wait a moment and try again. It's easy to forget semicolons when you're first beginning to program, but including them will soon become second nature. Most Java compilers give errors or warnings if
you attempt to use a variable before you have explicitly given it a value.
following is an example of an if statement: if (count > 20) System.out.println("Count exceeded"); K E Y CO NCEPT An if statement allows a program to choose whether to execute a particular statement. boolean equals (String str) Returns true if this string contains the same characters as str (including case) and false otherwise. The first one prints are
sentence that is somewhat long and will not fit on one line of the program. 6 Reading Input Data Casts are helpful in many situations where we need to treat a value temporarily as another type. The purpose of the program is essentially the same no matter which language is used, but the particular statements used to express the instructions, and
the overall organization of those instructions, vary with each language. They are both part of the Java standard class library and are defined in the java.text package. 1 Creating Objects Now consider the following object declarations: String name1 = "Ada, Countess of Lovelace"; String name2 = "Grace Murray Hopper"; Initially, the references
name1 and name2 refer to two different String objects: name1 "Ada, Countess of Lovelace" name1 into name2. For example, we could have called it Quote, or Abe, or GoodOne. Java is case-sensitive, which means that two identifies
names that differ only in the case of their letters are considered to K E Y CO NCEPT be different identifiers. The value calculated does not have K E Y CONC EP T to be a number, but often it is. It has been shown time and again that the effort spent on the design of a program is well worth it, saving both time and money in the long run. An escape
sequence begins with the backslash character or character
Celsius). iResult = num1 / num4; b. It also does not include an editor, although any editor that can save a document as simple text can be used. Compute the area of the triangle, and a, b, and c represent the lengths of the three sides. These fall into three
categories: Image words that we make up when writing a program (Lincoln and args) words that are reserved for special purposes in the language (class, public, static, and void) While writing the program, we simply chose to name the class Lincoln, but we could purpose in the language (class, public, static, and void) While writing a program, we simply chose to name the class Lincoln, but we could purpose in the language (class, public, static, and void) While writing the program, we simply chose to name the class Lincoln, but we could purpose in the language (class, public, static, and void) While writing a program (Lincoln and args) words that are reserved for special purposes in the language (class, public, static, and void) While writing the program (Lincoln and args) words that are reserved for special purposes in the language (class, public, static, and void) While writing the program (Lincoln and args) words that are reserved for special purposes in the language (class, public, static, and void) While writing the program (Lincoln and args) words that are reserved for special purposes in the language (class, public, static, and void) While writing the program (Lincoln and args) words that are reserved for special purposes in the language (class, public, static, and void) While writing the program (Lincoln and args) words that are reserved for special purposes in the language (class, public, static, and args) words that are reserved for special purposes in the language (class, public, static, and args) words that are reserved for special purposes in the language (class, public, static, and args) words that are reserved for special purposes in the language (class, public, static, and args) words that are reserved for special purposes in the language (class, public, static, and args) words that are reserved for special purposes in the language (class, public, static, and args) words that are reserved for special purposes in the language (class, public, static, and args) words that are reserved for special pu
have used one of many other possibilities. java.text Format text for output. Constants are identifiers and are similar to variables except that they hold a particular value for the duration of their existence. They are sometimes called software tools because they are used to build programs. "Twelve Days of Christmas." Mirth Without Mischief. are two
expressions separated by the : symbol. The same variable can appear on both the left-hand side and the right-hand side of an assignment statement. Comments do not affect a program, you attempt to translate it from high-level code into a form
that can be executed. Discuss wrapper classes and the concept of autoboxing. Explore the issues related to problem solving in general. Liftoff! Houston, we have a problem. They often go from one type to a type that uses less space to store a value, and therefore some of the information may be compromised.
---// Calculates fuel efficiency based on values entered by the // user. String front = description.substring(0, 10); SRA 3.7 A Java package is a collection of related classes. In the first both for
addition and for string call to println, both + operations perform string concatenation, beconcatenation. This results in a compile-time error. The design of software is no less essential. THE DOCUMENTS AND RELATED GRAPHICS CONTAINED HEREIN COULD INCLUDE TECHNICAL INACCURACIES OR TYPOGRAPHICAL ERRORS. import
java.net.*; EX 3.6 Assuming that a Random object called generator has been created, what is the range of the result of each of the first letter of the user's first name, followed by the first five characters of the
user's last name, followed by a random number in the range 10 to 99. static double exp (double power) Returns the value e raised to the specified power. assignment statement A programming statement that assigns a value to a variable. //-
672); System.out.println("Year in which Leonardo da Vinci invented" + "the parachute: " + 40 + " km per year"); } OU TPUT We present the following facts for your extracurricular edification: Letters in the Hawaiian alphabet: 12 Dialing code for Antarctica: 672 Year in which Leonardo da Vinci
invented the parachute: 1515 Speed of ketchup: 40 km per year 37 38 C H APTE R 2 Data and Expressions to append them. In most situations the compiler will issue an error if you attempt to use a variable before initializing it. Since the inception of computers, many programming languages have been created. Then you pass the value to be
formatted to the format method of the formatter object, which returns a properly formatted string. For instance, the Integer class represents a simple integer value. Assignment Operators As a convenience, several assignment operators have been defined in Java that combine a basic operation with assignment. Both uppercase and lowercase letters
can be used in an identifier, and the difference is important. For example, if the variable 2. Common Base Language." Norwegian Computing Center. Therefore, what the + operator does depends on the types of data on which it operates. Programs are
sometimes called applications. to programming. If the condition is true, the expand method is invoked (apparently to expand the size of the roster). 1101 1011 1101 1011 1001 ... //-
                                                                                                                                                                                                                                                           36 C H APTE R 2 Data and Expressions L I ST I N G 2 .1 continued public static void main(String[] args) {
System.out.print("Three..."); System.out.print("Two..."); System.out.print("Two..."); System.out.print("Tero..."); System.out.print("Tero..."); System.out.print("Three... (a + b) * c + d * e n. For example, once we define a class to represent the concept of a bank account, we
can create multiple objects that represent specific, individual bank accounts. java.net Communicate across a network. ASCII is a subset of K E Y CO NCEPT the Unicode character set. Either the value of count is greater than MAX or it isn't. Figure 3.3 lists some of the methods of the Random class. The nextLine method reads all of the input until the
of the + operator are strings, then string concatenation is performed. A Java Program Let's look at a simple but complete Java program. In Java, the + operator is used both for addition and for string concatenation does not change the value in
total. a % b % c % d h. */ This comment type does not use the end of a line to indicate the end of the comment. Some methods produce a value that is returned when the method completes. Equality operators are called equality operators. 4 Expressions stored in the variable count, overwriting the original
value of 15 with the new value of 16. Note that the value that the value that the value that the program PianoKeys, shown in Listing 2.5. The first line of the main method is the declaration of a variable named keys that holds
--// Determines the roots of a quadratic equation. It allows us to make another decision after determining the results of a previous decision. Figure 2.4 + a Evaluating a +
(b - c) / d / - b d c F IGURE 2. The biggest change in this edition is the overhaul of the graphical content to fully embrace the JavaFX platform, which has replaced Swing as the supported technology for graphics and Graphical User Interfaces (GUIs) in Java. Therefore, total, label7, nextStockItem, NUM BOXES, and $amount are all valid identifiers,
but 4th word and coin#value are not valid. theNextValueInTheList EX 1.4 Java is case-sensitive. Unless otherwise specified, the basic execution of a program proceeds in a linear fashion. Some development environments are available free, whereas others, which may have advanced features, must be purchased. Derived classes can then be used to
derive even more classes. Each problem has a problem domain, the real-world issues that are key to our solution. Consider alternatives to the solution and refine the solution and refine the solution. Which is the point of writing a program in the first place. A method is a group
of programming statements that is given a name. SRA 2.15 A widening conversion tends to go from a small data value, in terms of the amount of space used to store it, to a larger one. Most of this text is designed to flesh out these ideas. It is a ternary operator because it requires three operands. Accessing data leaves them intact in memory, but an
assignment statement overwrites the old data. SRA 3.9 The Scanner class and the Random class are part of the java.util package. comment Text included in a program to make the program easier to understand for humans. 1 2 C H APTE R 1 Introduction 1.1 The Java Programming Language A computer is made up of hardware and software.
Figure 3.1 lists some of the more useful methods of the String class. a - (b - c) - d i. boolean nextBoolean() byte nextByte() double nextDouble() float nextFloat() int nextInt() long nextLong() short nextShort() Returns the next input token as the indicated type. However, the Math class provides methods that perform exponentiation and many other
mathematical functions. The Java compiler translates the source code into bytecode, which can then be executed using the Java interpreter. 1.5 Object-Oriented language. Note that the assignment statement in this example is indented under the header line of the if
             67 68 C H APTE R 2 Data and Expressions SR 2.4 What is a parameter? Throughout this text, we explore techniques that enable us to design and implement elegant programs. If the roster is not yet full, the variable name is passed as a parameter to the addName method. The number is first converted (promoted) to a string, and then the
two strings are concatenated. For example, if total and count are both integer variables, then this statement will perform integer division operator truncates the fractional part before assigning the result to average is a floating point variable, the division operator truncates the fractional part before assigning the result to average is a floating point variable, then this statement will perform integer division: average is a floating point variable, then this statement will perform integer division.
set of Java operators is discussed in Appendix D. otherwise cause compilation problems.
--// Calculates the area and circumference of a circle given its // radius. Sun also has a Java IDE called NetBeans (www.netbeans.org) that incorporates the development tools of the NumberFormat class. ter set
in more detail. K E Y CO NCEPT Conditionals and loops enable us to control the flow of execution through a method. This class is called Lincoln, although we could have named it just about anything we wished. The following is an example of an expression that contains the conditional operator. An object variable doesn't hold the object itself, it holds
the address of an object. The various numbers used in programs such as Facts and Addition and PianoKeys are all integer literals. The reserved word null can be used to check for null references to avoid following them. K EY C ONC EPT Accessing data leaves them intact in memory, but an assignment statement overwrites the old data. But in the
string "602 Greenbriar Court" the 6, 0, and 2 are characters, just like the rest of the characters and include the characters are characters.
causes the value of count to be incremented: count++; The result is stored in the variable count. 

A variable is a name for a memory location used to hold a value of a particular data type. literal An explicit data
value used in a program. The size of each data type is the same for all hardware platforms. Java has three types of loop statement, and the for statement, the do statement, and the for statement, and the for statement are to find a program. The size of each data type is the same for all hardware platforms. Java has three types of loop statement, and the for statement, and the for statement, and the for statement are to find a program. The size of each data type is the same for all hardware platforms. Java has three types of loop statement, and the for statement, and the for statement are to find a program. The size of each data type is the same for all hardware platforms. Java has three types of loop statement, and the for statement are to find a program. The size of each data type is the same for all hardware platforms. Java has three types of loop statement, and the for statement are to find a program. The size of each data type is the same for all hardware platforms. Java has three types of loop statement, and the for statement are to find a program. The size of each data type is the same for all hardware platforms. Java has three types of loop statement, and the for statement are to find a program are to find
layout of the rooms and other crucial characteristics are the same in each. In professional development, the person or group that wants a software product development process, we should test our solution to find any errors that exist so that we can fix them
high-level language A programming language that is expressed in phrases that are easier than machine language for a programmer to understand. These are both unary operators because they operate on only one operand. For example, if we are going to write a program to score a bowling match, then the problem domain includes the rules of
bowling. The software developer must work with the client to refine the requirements until all key decisions about what the system will do have been addressed. Each variable on the line can be declared with or without an initializing value. SR 1.3 What is Java bytecode? We'll see more examples of relational operators as we examine conditional and
loop statements throughout this chapter. Its constructor takes a String parameter 3. (That is, don't make any character string longer than it has to be.) * *** ***** **** *** * 29 30 C H APTE R 1 Introduction PP 1.8 Write an application that displays your initials in large block letters. Throws InputMismatchException if the
next token is inconsistent with the type. The expressions add two numbers together. escape sequence A series of characters that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character that begin with a backslash (\), used to represent a special character than the speci
evaluated. However, a class is not an object any more than a blueprint is a house. A class is the model or blueprint from which an object as sentenced in the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts that the Scanner class of the java standard class library This declaration asserts the standard class library This declaration asser
attributes and methods defined in one class are inherited by its children, which in turn pass them on to their children, and so on. That is not to say that aliases are a bad thing. machine language executed by a particular CPU. EX 1.2 Which of the following are not valid Java identifiers? Once this declaration and instantiation are
performed, the ageObj object effectively represents the integer 40 as an object. Moreover, this sentence could describe the preferences of an unusual insect known as a "time fly," which might be found near an archery range. Chapter 4 (Conditionals and Loops) covers the use of Boolean expressions to make decisions. Classes and objects are used to
manipulate character strings, produce random numbers, perform complex calculations, and format output. The third kind of software problem is a logical error. For example, Integer (69); int num2; num2 = obj2; // automatic automatic conversions between primitive
values and corresponding wrapper objects. Within a given method, we can alter the flow of control through the code by using certain types of programming statements. Draw a graphical representation of the variable and its value. Figure 3.8 lists some of the methods found in the Integer class. That is, the SDK does not have a graphical user interface
(GUI), with windows, menus, buttons, and so on. 2 The if Statement condition evaluated true false statement: if (total > amount) total = total + (amount + 1); In this example, if the value in total is greater than the value in amount, the assignment
statement is executed; otherwise, the assignment statement is skipped. Chapter 6 (Graphical User Interfaces) is an exploration of GUI processing using the JavaFX platform, focusing on controls, events, and event handlers. 41 42 C H APTE R 2
Identifier = Expression Array Initializer A variable declaration consists of a Type followed by a list of variables. But at some point, all of these steps should be carefully addressed. K EY C ONC EPT The Scanner class provides methods for reading input of various types from various sources. int nextInt () Returns a random number that ranges over all
possible int values (positive and negative). First, let's review the effect of assignment on primitive values. SR 3.7 What is a Java package? We know that arrows don't time things, so we wouldn't normally interpret the sentence that way, but it is still a valid interpretation of the words in the sentence. VideoNote Example using strings and escape
sequences L I ST I N G The program in Listing 2.4, called Roses, prints some text resembling a poem. Because a character literal cannot span two lines in a program, we split the string into two and use string concatenation 2. Although our main goal is to learn these underlying software development concepts, an important side effect will be to
become proficient in the development of Java programs. They can also be applied before the variable (such as ++count or --count), in what is called the prefix form. compatible with the type of the variable on the left-hand side. But in many cases, maintaining a legacy system is still more cost-effective than migrating it to new technology, such as
writing it in a newer language. Every time the program is run, it produces the same result. All methods of the Math class are static, which means they are invoked through the class name. static double floor (double num) Returns the floor of num, which is the largest whole number less than or equal to num. An enumerated type is a special kind of
class, and the variables of an enumerated type are object variables. Examples: total MAX HEIGHT num1 computeWage System Although the Java language doesn't require it, using a consistent case format for each kind of identifier makes your identifiers easier to understand. Many different development environments exist to help you create and
modify Java programs. This program first declares an integer variable called sides and initializes it to 7. The computer ignores white space except when the white space is used to separate words. The getCurrencyInstance and getPercentInstance methods are called factory methods, because they produce and return an instance of an object set up in a
particular manner. Note that for efficiency, Java bytecode could be compiled into machine code. Compare that to the result of the logical OR operator (||), which is true if one or the other or both operands are true, but is false otherwise. This allows the programmer to use the class name (such as Random) without having to fully qualify the reference
(such as java.util.Random) every time. Once this import declaration is made, it is sufficient to use the simple name Scanner when referring to that class in the program. Usually, though, we need a random number within a more specific range. Explore the services provided by the String class. string concatenation Appending one character string to
the end of another. Together, they form a tool that we can use to solve problems. num2 = num1; The original value of 12 in num2 is overwritten by the value 5. F IG UR E 3.4 Some methods of the Math class The Quadratic program, shown in Listing 3.3, uses the Math class to compute the roots of a quadratic equation. This software is referred to assert
the Java API, which stands for Application Programmer Interfaces, or simply the standard class library. Java is an object-oriented programming language. The constructors of the wrapper classes accept the primitive value to store. These packages are available on any platform that supports Java software development. Java 2 Platform The most
recent Java technology. 2.3 Primitive Data Types There are eight primitive data type, and a boolean data type. For example, part of a bank account's state is its current balance, editor A software tool that allows one to enter text such as a program. The
class library is made up of several clusters of related classes, which are sometimes called Java APIs, or application programming interfaces. These problems gave rise to the use of assembly language, which replaced binary digits with mnemonics, short English-like words that represent commands or data. 1 The Java Programming Language The
code executed when the println method is invoked is not defined in this program. This chapter explores these ideas further. A block statement can be used anywhere a single statement is called for in Java syntax. An object should be encapsulated, which means it protects and manages its own information. We revisit this type of situation later in this
chapter when we formalize the precedence rules that define the order in which operators are evaluated. SR 3.13 Given a Random object called rand, what does the precedence rules that define the order in which operators are evaluated. SR 3.13 Given a Random object called rand, what does the precedence rules that define the order in which operators are evaluated. SR 3.13 Given a Random object called rand, what does the precedence rules that define the order in which operators are evaluated. SR 3.13 Given a Random object called rand, what does the precedence rules that define the order in which operators are evaluated. SR 3.13 Given a Random object called rand, what does the precedence rules that define the order in which operators are evaluated.
 kilometers. L I STING K EY C ONC EPT The print and println methods represent two services provided by the System.out object. 🔳 Testing. Mutation #4: NGX IS INXVITABLX, XXCXPT F Mutated length: 27 3. The + and - arithmetic operators can be either unary or binary. Carefully compare the output of the Countdown program, shown at the
Purchase java Java Foundations // // Demonstrates the use of the NumberFormat class to format output. They include chips, boxes, wires, keyboards, speakers, disks, cables, printers, and so on. These groups basically reflect the historical development of computer languages. An escape sequence can be used to represent a character that would
otherwise cause compilation problems. Figure 4.4 depicts a truth table that shows both the && operator and the || operator and the || operator and the || operator and the || operator and the way we use it in Lincoln, but we could have used just about any other identifier in its place. We've used the dot operator many times already, such as in
calls to System.out.println. The classes of the java.lang package are automatically imported because they are fundamental and can be thought of as basic extensions to the language. PP 3.2 Write an application that prints the sum of cubes. This section offers an overview of these ideas at a high level to
establish some terminology and provide the big picture. Narrowing conversions should be avoided because they can lose information. As far as the Java programming language is concerned, the content of comments can be any text whatsoever. On the other hand, when it's not clear what the range of a particular variable will be, we should provide a
reasonable—even a generous—amount of space. 2 Program Development 17 unambiguous, which means the semantics of a program are well defined. A cast is a Java operator that is specified by a type name in parentheses. For the string "James Gosling", the length method returns 13, which includes the space between the first and last names. (For
example, 9999 seconds is equivalent to 2 hours, 46 minutes, and 39 seconds.) PP 2.8 Write an application that determines the value of the Facts program. The syntax rules of a language
dictate exactly how the vocabulary elements of the language can be combined to form statements. value = Math.abs(total) + Math.pow(count, 4); Note that you can pass an integer value to a method that accepts a double parameter. A single high-level language sallow a programmer to ignore the underlying language programming
statement can accomplish the equivalent of details of machine language. Maintaining a legacy system is often a costly effort because, among other things, it is based on older technologies. It also conceptually introduces a stack, then explores an array-based implementation of a stack. Although this approach applies to any kind of problem solving, it
works particularly well when developing software. A null reference specifically indicates that a variable does not refer to an object. SRA 2.11 The result of 19%5 in a Java expression is 4. The precedence rules dictate that the multiplication happens before the addition in the final conversion computation. SR 3.15 Write a statement that prints the sine
executed. As always, favor the side of readability. Programmers can and should include comments as needed throughout a program to clearly identify the purpose of the program and describe any special processing. The SDK can be downloaded free of charge for various hardware platforms from Sun's Java Web site, java.sun.com. The point is that one
specific English sentence can have multiple valid meanings. Let's carefully dissect it and examine its pieces. Other tools that help you visualize your program structure. It gives us the ability to design powerful and elegant solutions to problems that deal with multiple
objects. If two classes from two different packages have the same name, import declarations will not suffice, because the compiler won't be able to figure out which class is being referenced in the flow of the code. This chapter explores some of the basic types of data used in a Java program and the use of expressions to perform calculations. 2.6
Reading Input Data It is often useful to design a program to read data from the industry-leading text Java Software Solutions for the introductory material, reworked to complement the design and vision of the overall text. It may seem that an else clause after a nested if
could apply to either if statement. Because both operands are numbers, the numbers are added in the arithmetic sense, producing the result 69.
print and printly. Because of the subtle differences between the prefix and postfix forms of the increment and decrement operators, they should be used with care. Before we discuss the details of conditional and loop statements, let's explore these operators. Primitive data include fundamental values such as numbers and characters. Multiple objects
Questions SRA 1.1 The hardware of a computer system consists of its physical components, such as a circuit board, monitor, and keyboard. The various Java conventions regarding identifiers should be followed, although technically they don't have to be. Carefully trace the logic of the MinOfThree program, using various input sets with the minimum
value in all three positions, to see how it determines the lowest value. A comment can follow code on the same line to document that particular line, as in the following example: System.out.println("Monthly Report"); // always use this title The second form a Java comment may take is /* This is another comment. Low-level design issues deal with how
individual methods accomplish their tasks. Then the program ends, or terminates. This call does not print any visible characters, but it does move to the next line of output. For example, a bank account object may store a floating point number (a primitive value) that represents the balance of the account. Collectively, the values of an object's
attributes define its current state. The if statement and other conditionals are explored in detail in this chapters. Earlier in this section we used the greater than operator (>) to decide whether one value was greater than another. Each machine
language instruction can accomplish only a simple task. Methods and their invocation are discussed further in the next chapter. At this point the object is called garbage because it serves Multiple reference variables can refer no useful purpose. The parentheses used in expressions are actually operators themselves. programming statement An
individual instruction in a programming language. The directions are the same no matter which language is used to explain them, but the manner in which the directions are expressed is different. Similar algorithms are sometimes used to generate usernames for new computer accounts.
 ---// Concatenates and adds two numbers and prints the results. SR 3.6 Write a declaration for a String variable called front and initialize it to the first 10 characters of another String object called description. Give two
examples of ambiguity in the English language (other than the example used in this chapter), and explain the ambiguity. Recall that a quadratic equation has the following general form: ax2 = bx = c 3. Five goes into 19 three times, with 4 left over. The AND and OR operators are both binary operators because each uses two operands. VideoNote
Example using the Random and Math classes 90 C H APTE R 3 Using Classes and Objects static int abs (int num) Returns the absolute value of num. The values of id and name are inserted into the string, producing a result such as ID: 24036 Name: Larry Flagelhopper The printf method was added to Java to mirror a similar function used in
programs written in the C programming language. An identifier that we make up for use in a program can be composed of any combination of letters, digits, the underscore character (), and the dollar sign ($), but it cannot begin with a digit. iResult = num3 / num4; d. PP 2.3 Write an application that reads two floating point numbers and prints their
sum, difference, and product. can be easily confused. For example, the Integer class contains methods that return the int value stored in the object and that convert the stored value to other primitive types. Polymorphism is the idea that we can refer to multiple types of related objects over time in consistent ways. The symbol for the conditional
operator is usually written?:, but it is not like other operators in that the two symbols that make it up are always separated. In fact, every time you pass an object to a method, you create an alias. Implement the solution. We revisit the issues related to testing in Chapter 11. Chapter 13 (Linked Structures—Stacks) discusses the use of references to
create linked data structures. A flight simulator may use random numbers to determine how often a simulated flight has engine trouble. Originally, the phrase "Change is inevitable" 3. The decrement operator (--) is similar except that it subtracts 1 from the value. Each object has space for its own data, which is why each object
can have its own state. For example, suppose a short variable that holds the number 1000 is converted to a byte value. Note that there is even a wrapper class that represents the type void. The act of declaration, just as
we do with primitive types: String title = new String("Java Foundations"); Even though they are not primitive types, character strings are so fundamental and are used so often that Java defines string literals delimited by double quotation marks, as we've seen in various examples. static NumberFormat getCurrencyInstance() Returns a NumberFormat
object that represents a currency format for the current locale. Nested if Statement executed as the result of an if statement could be another if statement could be another if statement. However, the division operator (/) produces results that are less intuitive, depending on the types of the operands. Label the chorus. These three types of lists are compared and
contrasted, with discussion of the operations that they share and those that are unique to each type. However, the same values could be represented using the identifiers Aminus, Bplus, and so on. The following are all examples of valid string literals: "The quick brown fox jumped over the lazy dog." "2201 Birch Leaf Lane, Blacksburg, VA 24060" "x" ""
A string literal can contain any valid characters, including numeric digits, punctuation, and other special characters. String findInLine (Pattern pattern) Attempts to find the next occurrence of the specified pattern, ignoring delimiters. Suppose we also wanted to represent plus and minus grades, such as A- and B+. A
far more useful version of the program would obtain the value to be converted from the user each time the program was executed. static double angle) static double angle os (double angle) static double angle) static double tan (double angle) static double angle) static double angle) static double angle os (double angle) static double angle) sta
both operands are floating point values, the The type of result produced by / operator performs floating point division, and the fractional part arithmetic division depends on the of the result is kept. Invoking a method alters the flow of control. 3 Primitive Data Types 427 had been used throughout the code, each use would have had to be found and
changed.
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