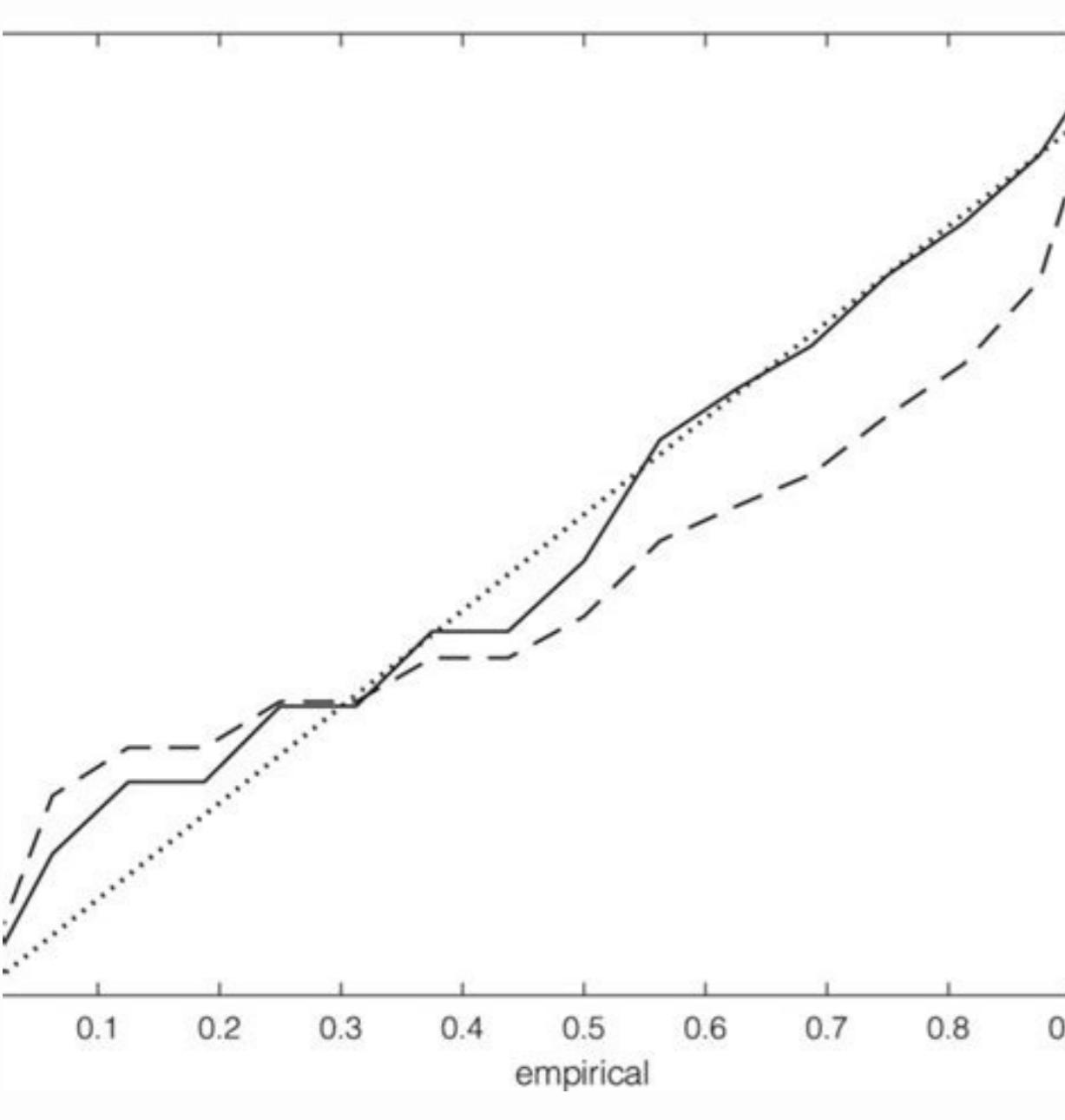


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# Binomial distribution questions and answers pdf

If  $X$  follows a binomial distribution with parameters  $n=6$  and  $p$  and  $9P(X = 4) = P(X = 2)$ , then  $p$  is



VSC

general  
Points out of 5.00  
# Your  
Answers

Use the binomial distribution chart (opens in a new window) to find the probabilities.

According to Inc.com, there is a 80% chance of a new business failing within the first five years. (Take note! This is one of those cases in which a "success" doesn't seem like what we think of as a success at all. In this case, we want to calculate probabilities regarding a business failing, so that's the "success" we are referring to.)

If a random group of 6 businesses are selected,

1. What is the probability that exactly 2 businesses will fail in the first 5 years?  $P(r = 2 | p = 0.5)$   
[Enter the probability only.] Click to hide hint  
Look in the column for  $p = 0.50$ . Find  $n = 6$  and look for the probability that goes with  $r = 2$ .

2. What is the probability that none will fail?  $P(r = 0 | p = 0.5)$   
[Enter the probability only.] Click to view hint

3. What is the probability that at least 5 fail?  $P(r \geq 5 | p = 0.5)$   
[Enter the probability only.] Click to view hint

4. What is the probability that all will fail?  $P(r = 6 | p = 0.5)$   
[Enter the probability only.] Click to view hint

Let  $p$  denote the probability of getting one defective item out of hundred. So  

$$p = \frac{5}{100}$$

$$p = \frac{1}{20}$$

$$q = 1 - \frac{1}{20}$$

$$q = \frac{19}{20}$$

[Since  $p + q = 1$ ]

Let  $X$  denote the random variable representing the number of defective items out of 10 items. Probability of getting  $r$  defective items out of  $n$  items selected is given by,

$$P(X = r) = {}^n C_r p^r q^{n-r}$$

$$= {}^{10} C_r \left(\frac{1}{20}\right)^r \left(\frac{19}{20}\right)^{10-r}$$

Probability of getting not more than one defective items

$$= P(X = 0) + P(X = 1)$$

$$= {}^{10} C_0 \left(\frac{1}{20}\right)^0 \left(\frac{19}{20}\right)^{10-0} + {}^{10} C_1 \left(\frac{1}{20}\right)^1 \left(\frac{19}{20}\right)^{10-1}$$

$$= 1 \cdot 1 \left(\frac{1}{20}\right)^0 + 10 \cdot \frac{1}{20} \left(\frac{19}{20}\right)^9$$

$$= \frac{1}{20} \left[ \left(\frac{1}{20}\right)^0 + 10 \cdot \left(\frac{19}{20}\right)^9 \right]$$

$$= \frac{29}{20} \left(\frac{19}{20}\right)^9$$

The required probability =  $\frac{29}{20} \left(\frac{19}{20}\right)^9$

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$= P(8) + P(9) + P(10) + P(11) + P(12) + P(13) + P(14) + P(15) + P(16) + P(17) + P(18) + P(19) + P(20)$   
 $= 0.67779$  b) It is a binomial distribution problem with the number of trials is  $n = 500$ . Samples of 1000 tools are selected at random and tested. The total number of balls is 10 and there are 3 red, hence each time a ball is selected, the probability of getting a red ball is  $p = 3/10 = 0.3$  and hence we can use the formula for binomial probabilities to find  $P(\text{the red color shows once}) = P(\text{the red color does not show}) = P(\text{the red color shows at least twice}) = 1 - P(\text{the red color shows at most 1}) = 1 - 0.11765 - 0.30253 = 0.57982$ . Example 8 80% of the people in a city have a home insurance with "MyInsurance" company.  $\binom{n}{k}$  is the combinations of  $n$  items taken  $k$  at the time and is given by factorials as follows:  $\binom{n}{k} = \frac{n!}{k!(n-k)!}$   $\binom{n}{n} = 1$  times 2 times 3 times ... . What is the probability that exactly 3 heads are obtained? What is the probability that a student will answer 15 or more questions correctly (to pass) by guessing randomly? b) If 500 people are selected at random, how many are expected to have a home insurance with "MyInsurance"? Example 2 A fair coin is tossed 5 times. 6 times, a ball is selected at random, the color noted and then replaced in the box. a) Find the mean and give it a practical interpretation. Example 1 A fair coin is tossed 3 times. Solution to Example 2 The coin is tossed 5 times, hence the number of trials is  $n = 5$ . If a question is answered by guessing randomly, the probability of answering it correctly is  $p = 1/4 = 0.25$ . United Kingdom:  $\mu = 0.508$  and  $\sigma = 0.200,000$  mean:  $\mu = n \cdot p = 200,000 \cdot 0.508 = 101,600$  out of 200,000 are expected to have tertiary education in the UK. Conclusion. Solution to Example 4 When a tool is selected, it is either in good working order with a probability of 0.98 or not in working order with a probability of 1 - 0.98 = 0.02. b) Find the standard deviation of the number of tools in good working order in these samples. Solution to Example 7 The event "the red color shows at least twice" is the complement of the event "the red color shows once or does not show"; hence using the complement probability formula, we write  $P(\text{the red color shows at least twice}) = 1 - P(\text{the red color shows at most 1}) = 1 - P(\text{the red color shows once})$  or "the red color does not show". Using the addition rule  $P(\text{the red color shows at least twice}) + P(\text{the red color shows once}) + P(\text{the red color does not show})$  Although there are more than two outcomes (3 different colors) we are interested in the red color only. times  $(n - 1)$  times  $n$ , is read as  $(n \cdot n)$  factorial. c) standard deviation:  $\sigma = \sqrt{\mu(n \cdot \mu \cdot (1-p))} = \sqrt{0.508 \cdot 101,600 \cdot 0.02} = 10.11765$ . The probability that a student will answer 10 questions or more (out of 20) correctly by guessing randomly is given by  $P(\text{answer at least 10 questions correct}) = P(10) + P(11) + \dots$ . The coin being a fair one, the outcome of a head in one toss has a probability  $p = 0.5$  and an outcome of a tail in one toss has a probability  $1 - p = 0.5$ . The probability of having 3 heads in 5 trials is given by the formula for binomial probabilities above with  $n = 5$ ,  $k = 3$  and  $p = 0.5$ .  $P(3) = \binom{5}{3} (0.5)^3 (1-0.5)^{5-3} = 0.3125$ . Example 3 A fair die is rolled 7 times, find the probability of getting "6" 5 times exactly. Use formula for combinations to calculate  $\binom{7}{5} (0.5)^5 (0.5)^2 = 0.3125 \cdot 0.03125 = 0.009375$ . Note 1) The last five probabilities are not exactly equal to 0 but negligible compared to the first 5 values. What is the probability that a student will answer 10 or more questions correctly (to pass) by guessing randomly? Home Page Solution to Question 4 In both cases, it is a binomial experiment with Canada:  $\mu = 0.618$  and  $\sigma = 0.200,000$  out of 200,000 are expected to have tertiary education in Canada. Solution to Example 5 The number of trials is  $n = 7$ . c) Find the probability that at most 3 even numbers are obtained. If 200,000 people in the age between 25 and 34 years, are selected at random in Canada and 200,000 in the same age group are selected at random in the United Kingdom, how many are expected to have tertiary education in each of these two countries?  $P(\text{student answers 15 or more}) = P(\text{student answers 15 or 16}) = P(15) + P(16) + P(17) + P(18) + P(19) + P(20)$  Using the binomial probability formula  $P(\text{student answers 15 or more}) = \binom{20}{15} (0.2)^{15} (1-0.2)^{20-15} + \binom{20}{16} (0.2)^{16} (1-0.2)^{20-16} + \dots + \binom{20}{20} (0.2)^{20} (1-0.2)^{20-20}$  Conclusion: Answering questions randomly by guessing gives no chance at all in passing a test. The best way to explain the formula for the binomial distribution is to solve the following example. What is the probability that the red color shows at least twice? Solution to Example 6 Each question has 4 possible answers with only one correct. The solution is the same as in Example 5. The die is rolled 7 times, hence the number of trials is  $n = 7$ , we are interested in the red color only. times  $(n - 1)$  times  $n$ , is read as  $(n \cdot n)$  factorial. d) standard deviation:  $\sigma = \sqrt{\mu(n \cdot \mu \cdot (1-p))} = \sqrt{0.3125 \cdot 7 \cdot 0.03125} = 0.16406$ . The probability that at least 8 out of 10 people, at random, at the time, the probability that a selected person to have home insurance with "MyInsurance" is 0.98. This is a binomial experiment with  $n = 10$  and  $p = 0.8$ . "at least 8 of them have a home insurance with "MyInsurance" means 8 or 9 or 10 have a home insurance with "MyInsurance". The probability that at least 8 out of 10 have home insurance with "MyInsurance" is given by  $P(\text{at least 8}) = P(8) + P(9) + P(10)$ . Use binomial probability formula called "MyInsurance" as a "success". The coin being a fair one, the outcome of a head in one toss has a probability  $p = 0.5$ . Example 7 A box contains 3 red balls, 4 white balls and 3 black balls. Mean:  $\mu = 3 \cdot \frac{1}{10} = 0.3$ . Standard Deviation:  $\sigma = \sqrt{\mu(n \cdot \mu \cdot (1-p))} = \sqrt{0.3 \cdot 10 \cdot 0.7} = 1.778$ . Binomial Probability Distribution Calculator: addition rule of probability, multiplication rule of probability, probability questions classical formula of probability mutually exclusive events introduction to Probabilities sample space event elementary statistics and probabilities. NOTE: these questions are very similar to question 5 above, but here we use binomial probabilities in a real life situation that most students are familiar with. b) Find the probability that at least 3 even numbers are obtained. In a single trial, the outcome of a "6" has probability  $p = 1/6$  and an outcome of "no 6" has a probability  $1 - p = 1 - 1/6 = 5/6$ . The probability of having 5 "6" in 7 trials is given by the formula for binomial probabilities above with  $n = 7$ ,  $k = 5$  and  $p = 1/6$ .

