

Binomial Distribution

- Q1. The probability that a certain kind of component will survive a shock test is $\frac{3}{4}$. Find the probability that exactly 2 of the next 4 components tested survive.
- Q2. The probability that a patient recovers from a rare blood disease is 0.4. If 15 people are known to have contracted this disease, what is the probability that (a) at least 10 survive, (b) from 3 to 8 survive, and (c) exactly 5 survive?
- Q3. A large chain retailer purchases a certain kind of electronic device from a manufacturer. The manufacturer indicates that the defective rate of the device is 3%. (a) The inspector randomly picks 20 items from a shipment. What is the probability that there will be at least one defective item among these 20? (b) Suppose that the retailer receives 10 shipments in a month and the inspector randomly tests 20 devices per shipment. What is the probability that there will be exactly 3 shipments each containing at least one defective device among the 20 that are selected and tested from the shipment?
- Q4. It is conjectured that an impurity exists in 30% of all drinking wells in a certain rural community. In order to gain some insight into the true extent of the problem, it is determined that some testing is necessary. It is too expensive to test all of the wells in the area, so 10 are randomly selected for testing. (a) Using the binomial distribution, what is the probability that exactly 3 wells have the impurity, assuming that the conjecture is correct? (b) What is the probability that more than 3 wells are impure?
- Q5. In a certain city district, the need for money to buy drugs is stated as the reason for 75% of all thefts. Find the probability that among the next 5 theft cases reported in this district, (a) exactly 2 resulted from the need for money to buy drugs; (b) at most 3 resulted from the need for money to buy drugs.
- Q6. One prominent physician claims that 70% of those with lung cancer are chain smokers. If his assertion is correct, (a) find the probability that of 10 such patients recently admitted to a hospital, fewer than half are chain smokers; (b) find the probability that of 20 such patients recently admitted to a hospital, fewer than half are chain smokers.
- Q7. In testing a certain kind of truck tire over rugged terrain, it is found that 25% of the trucks fail to complete the test run without a blowout. Of the next 15 trucks tested, find the probability that (a) from 3 to 6 have blowouts; (b) fewer than 4 have blowouts; (c) more than 5 have blowouts.
- Q8. A traffic control engineer reports that 75% of the vehicles passing through a checkpoint are from within the state. What is the probability that fewer than 4 of the next 9 vehicles are from out of state
- Q9. A safety engineer claims that only 40% of all workers wear safety helmets when they eat lunch at the workplace. Assuming that this claim is right, find the probability that 4 of 6 workers randomly chosen will be wearing their helmets while having lunch at the workplace.

Poisson Distribution

- Q1. During a laboratory experiment, the average number of radioactive particles passing through a counter in 1 millisecond is 4. What is the probability that 6 particles enter the counter in a given millisecond?
- Q2. Ten is the average number of oil tankers arriving each day at a certain port. The facilities at the port can handle at most 15 tankers per day. What is the probability that on a given day tankers have to be turned away?
- Q3. Suppose that the number of typographical errors on a single page of this book has a Poisson distribution with parameter $\lambda = 1.2$. Calculate the probability that there is at least one error on this page.
- Q4. Consider an experiment that consists of counting the number of α particles given off in a 1-second interval by 1 gram of radioactive material. If we know from past experience that, on the average, 3.2 such α particles are given off, what is a good approximation to the probability that no more than 2 α particles will appear?
- Q5. Suppose that earthquakes occur in the western portion of the United States in accordance with assumptions 1, 2, and 3, with $\lambda = 2$ and with 1 week as the unit of time. (That is, earthquakes occur in accordance with the three assumptions at a rate of 2 per week.) (a) Find the probability that at least 3 earthquakes occur during the next 2 weeks.
- Q6. On average, a textbook author makes two word processing errors per page on the first draft of her textbook. What is the probability that on the next page she will make (a) 4 or more errors? (b) no errors?
- Q7. On average, 3 traffic accidents per month occur at a certain intersection. What is the probability that in any given month at this intersection (a) exactly 5 accidents will occur? (b) fewer than 3 accidents will occur? (c) at least 2 accidents will occur?

Approximation

- Q1. The probability that a person will die when he or she contracts a virus infection is 0.001. Of the next 4000 people infected, what is the mean number who will die?
- Q2. In a certain industrial facility, accidents occur infrequently. It is known that the probability of an accident on any given day is 0.005 and accidents are independent of each other. (a) What is the probability that in any given period of 400 days there will be an accident on one day? (b) What is the probability that there are at most three days with an accident?
- Q3. In a manufacturing process where glass products are made, defects or bubbles occur, occasionally rendering the piece undesirable for marketing. It is known that, on average, 1 in every 1000 of these items produced has one or more bubbles. What is the probability that a random sample of 8000 will yield fewer than 7 items possessing bubbles?

Hypergeometric distribution.

Q1. There are 66 bulbs in a house out of which 33 are defective. If 22 bulbs are picked randomly, find the probability that

- a) at least one is defective.
- b) At most 4 are defective.

Q2. A crate contains 50 light bulbs of which 5 are defective and 45 are not. A Quality Control Inspector randomly samples 4 bulbs without replacement. Let X = the number of defective bulbs selected. Find the probability

- a) All the bulbs are defective
- b) Less than 2 bulbs are defective

Q3. A batch of 20 integrated circuit chips contains 20% defective chips. A sample of 10 is drawn at random. X = the number of defective chips in the sample. Find the probability that

- a) At least 3 are defective.
- b) At most 2 are defective.
- c) No one is defective.

Q4. A store has 20 guitars in stock but 3 are defective. Claire buys 5 guitars from this lot. Find the probability that

- a) Claire bought 2 defective guitars
- b) At least one guitar is defective

Q5. A public accounts committee of 5 persons to be set out of 12 members from ruling party and 8 members from opposition party. What is the probability that:

- a) 3 members of opposition party is selected?
- b) Not more than 2 members of opposition party is selected?

Q6. From a lot of 10 missiles, 4 are selected at random and fired. If the lot contains 3 defective missiles that will not fire, what is the probability that

(a) all 4 will fire?

(b) at most 2 will not fire?

Q6. It is estimated that 4000 of the 10,000 voting residents of a town are against a new sales tax. If 15 eligible voters are selected at random and asked their opinion,

what is the probability that at most 7 favor the new tax?

Q1. Find the value of z if the area under a standard normal curve

(a) to the right of z is 0.3622;

(b) to the left of z is 0.1131;

(c) between 0 and z , with $z > 0$, is 0.4838;

(d) between $-z$ and z , with $z > 0$, is 0.9500

Q2. Given a standard normal distribution, find the value of k such that

(a) $P(Z > k) = 0.2946$;

(b) $P(Z < k) = 0.0427$;

(c) $P(-0.93 < Z < k) = 0.7235$.

Q3. Given a normal distribution with $\mu = 30$ and $\sigma = 6$, find

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| a) the normal curve area to the right of $x = 17$; | (d) the value of x that has 80% of the normal curve area to the left; |
| (b) the normal curve area to the left of $x = 22$; | (e) the two values of x that contain the middle 75% of the normal curve area. |
| (c) the normal curve area between $x = 32$ and $x = 41$; | |

Q4. A certain type of storage battery lasts, on average, 3.0 years with a standard deviation of 0.5 year. Assuming that battery life is normally distributed, find the probability that a given battery will last less than 2.3 years.

Q5. An electrical firm manufactures light bulbs that have a life, before burn-out, that is normally distributed with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a bulb burns between 778 and 834 hours.

Q6. In an industrial process, the diameter of a ball bearing is an important measurement. The buyer sets specifications for the diameter to be 3.0 ± 0.01 cm. The implication is that no part falling outside these specifications will be accepted. It is known that in the process the diameter of a ball bearing has a normal distribution with mean $\mu = 3.0$ and standard deviation $\sigma = 0.005$. On average, how many manufactured ball bearings will be scrapped?

Q7. A certain machine makes electrical resistors having a mean resistance of 40 ohms and a standard deviation of 2 ohms. Assuming that the resistance follows a normal distribution and can be measured to any degree of accuracy, what percentage of resistors will have a resistance exceeding 43 ohms?

Q8. The average grade for an exam is 74, and the standard deviation is 7. If 12% of the class is given As, and the grades are curved to follow a normal distribution, what is the lowest possible A and the highest possible B?