Microsoft Excel

We can use the binomial distribution function, **BINOM.DIST(number_s, trials, probability_s, cumulative)** to find the probability that less than half of the survey respondents voted for the current governor. This number subtracted from 1 is the probability that at least half of the respondents voted for the current governor.

In an empty cell, type "=1-BINOM.DIST(99, 200, 0.441, TRUE)" and press Enter. The value given is 0.054141885.

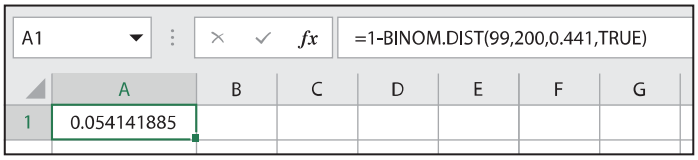

Figure 10.5.13

Therefore, the probability that more than half of the survey respondents voted for the current governor in the last election is approximately 5.4%.

Skill Check Answers

1. a. Yes **b.** No; there are ore than two outcomes. **c.** No; there is not a fixed number of trials, and the probability of getting an ace changes with each draw unless the card is replaced each time.

2. $P(\text{At Least 4 Sixes}) = P(4\text{ Sixes}) + P(5\text{ Sixes}) + P(6\text{ Sixes}) + P(7\text{ Sixes}) + P(8\text{ Sixes}) + P(9\text{ Sixes}) + P(10\text{ Sixes})$

10.5 Exercises

✔ CONCEPT CHECK

1. In a binomial experiment, the two possible outcomes are labeled as "_____" and "_____."

2. The probability of at least 3 successes in a binomial experiment is an example of _____ probability.

3. True or False: In a binomial experiment, the probability of getting a success must be the same for every trial.

4. True or False: The phrases "Greater than" and "Does not exceed" mean the same thing.

PRACTICE

5. Counting the number of broken lightbulbs in a case of lightbulbs.

6. Surveying whether restaurant customers prefer mild, medium, or hot salsa on their tacos.

7. Surveying whether customers at a local ice cream shop prefer their ice cream served in a cup or a cone.

8. Counting the number of male and female lions out of the six lions at a local zoo.

9. Randomly selecting five theater majors to participate in an upcoming play from a group of 40 students comprised of theater majors and non-theater majors.

10. Asking a class of 32 students whether they would prefer the final exam to be free answer or multiple choice.

11. Asking the employees of a small business whether they'd prefer a catered lunch of tacos, pizza, or neither.

12. Asking each audience member in a theater whether they enjoyed the movie they just watched or not.

13. Determining the number of pickles in each jar of a case of 16 jars of pickles.

14. Asking the 140 guests at a wedding whether they would prefer chicken or steak for their dinner entree.

15. Counting the number of true questions on a 20-question true-or-false test.

16. Tracking whether patients entering the ER during an afternoon are having chest pain or not.

APPLICATIONS

Calculate the binomial probability. Round your answer to the nearest ten-thousandth, if necessary.

17. What is the probability of getting exactly 4 heads in 8 coin tosses?

18. When rolling a standard 6-sided die 9 times, what is the probability of the die landing on an even number exactly 2 times.

19. A spinner for a board game has 10 wedges, 4 of which are blue while the other wedges are red. What is the probability of the spinner landing of red exactly 4 times if it is spun 5 times.

20. A spinner at a carnival has 8 wedges. Landing on one specific wedge wins a prize while landing on any of the other wedges does not win a prize. If the spinner is spun 5 times, what in the probability that exactly zero prizes are won.

21. Data collected from parents indicates that 12% of children attending a summer camp are allergic to bees. If 10 children are stung by bees during the summer camp, what is the probability that exactly 8 of the children are not allergic to bees.

22. Data pulled from the 72 resumes for a data entry position indicates that 75% of applicants have previous experience for the job. If 6 resumes are pulled at random for the first round of interviews, what is the probability that exactly 4 of the candidates have previous experience?

23. According to a survey of 75 dentists, 84% recommend that their patients with gum inflammation use a pH-balanced mouthwash. If 5 of these dentists are asked at random, what is the probability that exactly 2 of them recommend a pH-balanced mouthwash?

24. Tea Leaves magazine surveyed its readers and discovered that 62% of them prefer milk in their tea instead of sugar. If 20 readers were surveyed at random, what is the probability that exactly 12 of them would prefer milk in their tea?

25. The manager of a bookstore discovers that 16% of customers enjoy sitting in the bookstore café to read. What is the probability that exactly 9 out of 10 randomly selected customers do not enjoy sitting in the bookstore café to read?

26. Human resources learns that 54% of all workplace accidents happen during third shift. If 9 accidents are reported in one week, what is the probability that 4 of them did not happen during third shift?

27. The local hospital's data indicate that 52.5% of newborn babies are boys. What is the probability that of the next 7 newborn babies, less than 3 will be boys?

28. The probability of certain flower seeds sprouting is estimated to be 86%. If 20 seeds are sowed, what is the probability that no more than 3 will not sprout?

29. Suppose that 60% of tickets for a certain lottery win a prize and the remaining 40% do not win anything. If Carol buys twenty lottery tickets, what is the probability that the number of winning tickets will not exceed ten?

30. It is believed that about 10% of people in the world have blue eyes. What is the probability that out of 30 randomly chosen people, at most 5 will have blue eyes?

31. About 7% of people in the world use Spanish as their native language. If 50 random people are selected, what is the probability that fewer than seven of them are Spanish native speakers?

32. Suppose that 1% of juice cans come underfilled from the filling machine. What is the probability that in a batch of 100 juice cans, no more than two will be underfilled?

33. Heating is one of the ways to improve the quality of a natural gem. The gem is put into a high-temperature flame for a specific time and then allowed to cool slowly. This process can enhance the color of the gem and remove the inclusions. If we assume that about 3% of the gems get significantly better color and clarity after the heat treatment, what is the probability that of 10 gemstones, at least 2 will become significantly better?

34. If an archer has an 80% chance to hit the target, what is the probability that he will hit it at least 8 times in 10 tries?

35. A machine includes a set of 8 identical nodes, and it can continue working while at least 6 nodes are functioning correctly. If the probability of each node failing at any particular moment is 0.6%, what is the probability that the machine will stop working?

36. As a part of an advertising campaign, each chocolate bar of a particular company comes with a sticker hidden inside. Jacob wants to collect all 15 different stickers, and now he is missing only one. If the chance of getting each sticker is the same and Jacob buys five chocolate bars, what is the probability that he will find more than one copy of the missing sticker?

37. Suppose eight cards are drawn with replacement from a standard deck of cards. What is the probability that the number of red cards drawn is no less than six?

38. Nine fair six-sided dice are thrown. What is the probability of getting a 1 on more than two dice?

39. The probability of winning when placing a bet on a single color (either red or black) in a game of roulette is 18/38. What is the probability of winning more than half of such bets in 20 roulette games?

40. A recent survey showed that about 9% of adult people in the US do not have a car in the household. If 40 adult US people are chosen at random, what is the probability that a minimum of six of them do not have a car?

41. Suppose that 12% of people in a certain population suffer from migraines. If 40 people are selected at random from this population, what is the probability that at least 5 of them suffer from migraines?

42. In a recent survey conducted among young adults, about a quarter of respondents stated that they are indifferent toward the political life of their country. If a group of 30 young adults is selected at random, what is the probability that the number of people indifferent to politics will be greater than or equal to 7?

43. About 45% of the US population have blood type O. What is the probability that at least 10 out of 20 randomly selected US people have blood type O?

44. According to the 2019 National Survey on Drug Use and Health, about 55% of US adults aged 26 or older drank alcohol in the latest month. If 25 US adults are chosen at random, what is the probability that at least 15 of them have consumed alcohol in the latest month?

45. There are three major colors of Labrador Retrievers: black, brown, and yellow. The individual color depends on the combination of several specific genes. When two black Labradors with a particular genetic code are mated together, there is about a 25% chance for each of their puppies to have a yellow coat. If there are 7 puppies in a litter of two such black Labradors, what is the probability that more than 3 of them are yellow?

46. In a certain survey, 26% of adult respondents indicated that they did not have any physical activity during the week preceding the survey. If 15 adult people are randomly selected from the population being surveyed, what is the probability that at least 10 of them have exercised in the past week?

10.5 PROJECT

AMERICA'S THIRD FAVORITE PET: CAN WE PREDICT THEIR FUR COLOR?

According to the Humane Society of the United States, rabbits are the third most popular type of mammal owned as pets, with cats and dogs ranking higher. In this activity, you will calculate the probability of seeing a particular fur color when breeding rabbits.

Suppose that a particular breed of rabbit can be one of two colors: gray or white. The color of this breed of rabbit is determined by whether it has at least one dominant allele G in its genotype or whether it has only the recessive allele g. Out of the three possible genotypes (GG, Gg, and gg), rabbits with genotypes GG and Gg exhibit gray fur while rabbits with genotype gg exhibit white fur. Assume that each parent passes on one of its two color alleles to each offspring with equal probability.

If we breed two gray rabbits of genotype Gg, the possibilities for the fur color of the offspring are given in the following table.

	G	g
G	GG 	Gg 
g	Gg 	gg