Example 1.2.6

Using the Wisdom of the Crowd

Thirty people were asked to estimate the attendance at an outdoor community concert to the nearest 10. Their estimates are shown in Table 1.2.1. Use the crowd-sourced data to make an estimate of the community concert attendance.

Table 1.2.1: Community Concert Attendance Estimates

370	210	310	270	300	260
270	220	270	320	220	330
240	280	230	300	310	200
210	260	240	250	260	300
200	260	310	340	350	290

Solution

One method of making an estimate could be to look for the number that was most commonly guessed. However, the wisdom of the crowds says that the average of many estimates is better than a single estimate. So instead of using a single number, we can add all of the estimates together and divide by the number of estimates (30).

The sum of all of the estimates is 8180. Dividing by 30, we have the following.

$$\frac{8180}{30} \approx 272.7$$

Thus, we should estimate that there were approximately 273 people at the community concert.

Skill Check Answers

1. Tens (In 2021, there were 13 member countries) **2.** Only the estimation for food will change; \$10,450 for 50 guests and \$17,200 for 200 guests **3.** Approximately 1.6 billion people

1.2 Exercises

✔ CONCEPT CHECK

1. The values 10 minutes, 10 hours, and 10 days are examples of _____.

2. Breaking the original question into _____ questions can make estimating easier.

3. True or False: Collective intelligence is used to make a more accurate estimate than a single person can make.

4. True or False: When making an estimate, you should never round the values in your calculations.

PRACTICE

Determine the most appropriate order of magnitude for each situation.

5. Student enrollment at a university

6. Number of hamburgers sold worldwide every day

7. Number of flavors of ice cream sold at a local ice cream stand

8. Number of seats in a movie theater

For each estimation, determine which piece of information would be most helpful. Explain your reasoning.

9. Estimate the average gestation period of an Asian elephant.
   - **a.** The average lifespan of an Asian elephant
   - **b.** The average weight of newborn Asian elephant
   - **c.** The average number of elephants born each year
   - **d.** The average weight of a newborn human

10. Estimate the number of pounds of food served for lunch at a local elementary school each day.
    - **a.** The average weight of a sandwich
    - **b.** The average weight of the students
    - **c.** The number of students who attend the elementary school
    - **d.** The length of the lunch period

11. Estimate the total number of hours employees of a certain company spend in meetings per year.
    - **a.** The number of employees who work in the office
    - **b.** The number of meeting rooms in the office
    - **c.** The average number of minutes employees spend in the breakroom each day
    - **d.** The average number of vacation days employees get per year

12. Estimate the length, in minutes, of the audiobook recording of this year's best-selling fiction novel.

a. The number of chapters in the novel

b. The number of five star reviews the novel received

c. The average amount of time it takes to read a single page out loud

d. The average length of the audiobook recording of the top five best-selling fiction novels from the past five years

APPLICATIONS

Estimate the indicated cost.

13. A city is planning a new 3-acre park that will include a playground, a walking trail, and several picnic shelters. Previous parks the city constructed that were similar in amenities averaged 5-acres in size with cost an average of $900,000 to create. Estimate the cost to create the new park.

14. The Ziegler family plans to create a cement patio in their backyard to use for picnics and grilling. They'd like the patio to be a rectangle that is 18 feet by 20 feet. The previous year, they had a cement patio poured onto the side entrance of their house that was 7 feet by 4 feet, which cost $250. Estimate the cost of the new backyard patio. Round your answer to the nearest dollar.

15. A family of four plans to go on a seven-night vacation next summer. The previous summer, they went to a similar location for a four-night trip and spent $4500 total. Estimate the cost of a seven-night vacation.

16. The Wild Flower Foundation is planning their annual Bee the Difference fundraising dinner. The previous dinners had a maximum of 100 seats available and cost on average $8500 to host (including venue, food, and entertainment). This year, the foundation wants to increase the seating capacity to 175. Estimate the budget they should expect for this year's fundraising dinner.

Break each situation down into smaller parts.

17. You are hosting a birthday party for an 8-year-old child. A total of 20 children plus their parents will attend. You need to estimate the total cost of the party.

18. You are building a new house that needs three bedrooms, two bathrooms, and an attached garage. You need to estimate the total cost to build the house.

19. You and a friend are opening a restaurant. You need to estimate the upfront costs to run the restaurant for 6 months.

20. You are planning a destination wedding and will cover the travel expenses for members of the bridal party. You need to estimate the cost of the wedding.

Solve.

21. A local café sells beverages and pastries and is open for 8 hours each day. On average, customers spend $6.73 per order. The café averages 24 orders per hour.

a. Estimate the amount of money made by the café in one day.

b. Estimate the amount of money made by the café in one week.

22. A new video streaming service claims to have over 700,000 hours of video available for streaming. Each day, an average of 47,882 subscribers use the streaming service for approximately 126 minutes each.

a. Estimate the number of hours of video that is streamed each day.

b. Estimate the number of hours of video that is streamed each month.

23. A local food bank takes donations of nonperishable foods every day of the year. The average donation weighs 6.25 pounds, and the food bank receives approximately 32 donations per day.

a. Estimate how many pounds of donated food the food bank receives per month.

b. Estimate how many pounds of donated food the food bank receives per year.

24. A taco truck is open for business during a 4-hour window each day. They fulfill an average of 46 orders per hour and each order has an average of 12 tacos.

a. Estimate the number of tacos that are served each day.

b. Estimate the number of tacos that are served each month.

25. A farmer is estimating his expected crop yield for the season. He has a farm that is 250 acres, and he planted corn on 100 acres. He planted 31,000 seeds per acre and expects 95% of the seeds to germinate and grow into full stalks. Based on previous years, the farmer expects an average of one ear of corn per stalk. Estimate the number of ears of corn per acre and then estimate the expected corn crop yield for the season.

26. A local news network is estimating the number of people attending a parade based on aerial footage. A single block of the parade route is determined to hold 173 people. The parade route is 24 blocks long. Estimate the number of people who attended the parade.

27. A bakery held a contest for people to guess how many sprinkles are on the top of a cake. The winner would receive a $50 gift card. You determine that the cake is a half-sheet, meaning it measures 18-by-13 inches. You count that there are 31 sprinkles on a section of cake that is approximately one square inch in area. Based on this information, how many sprinkles would you guess are on the cake?

28. An editor is asked to give an estimate for the cost to edit a chapter of a book. To create the estimate, she needs to first determine the number of words in the chapter. The chapter is 56 pages long and the first two pages of the chapter each have an average of 472 words. How many words should she estimate are in the chapter?

29. Twenty people are asked to estimate the number of tacos sold by a local taco stand per day, rounded to the nearest ten. Their estimates are shown in the following table. Use the crowd-sourced data to make an estimate of the number of tacos sold per day by the local taco stand.

840	890	840	810	870
730	810	720	790	770
870	870	800	830	760
760	830	820	780	800

30. Twenty-five people are asked to estimate the number of people who attend a local corn festival per day, rounded to the nearest ten. Their estimates are shown in the following table. Use the crowd-sourced data to make an estimate of the number of corn-fest attendees per day.

810	960	870	1170	920
870	1030	860	1000	890
1160	920	1080	1060	1150
1070	1010	980	1120	820
1100	890	860	1100	1190

31. A contest is held to guess the number of jelly beans in a jar. The guesses of 20 people are provided in the following table. Use the crowd-sourced data to make an estimate of the total number of jelly beans in the jar.

282	312	328	331	311
373	341	328	284	308
277	353	277	389	275
385	280	286	374	277

32. Twenty-five college students are asked to estimate the number of minutes they think students spend on social media per day. Their estimates are shown in the following table. Use the crowd-sourced data to estimate the total number of minutes students spend on social media per day.

103	162	168	167	124
151	174	176	218	116
148	194	158	181	170
182	91	144	156	154
204	191	166	91	202

33. Suppose your project needs one project manager, two user-experience professionals, and three app developers. The rates for each of these team members are as follows.

Project manager: $118.50 per hour

User-experience professionals: $88 per hour

App developers: $125 per hour

The project requires the project manager for 100 hours, each user experience professional for 50 hours, and each app developer for 100 hours. Estimate the total cost of the project.

34. In his first week at college, Chase spent the following.

Entertainment: $28

Apparel: $24

Travel (gas): $18

If there are 12 weeks in the semester, estimate the amount of money Chase will spend on these things throughout the semester.

35. Trying to prepare a budget for his first few months in his new place, Darren has done research and found the following average costs per month: health insurance $183, phone/internet/cable $140, electric $179. If Darren will be earning $1700 per month, estimate the amount of money he will have after paying these bills each month.

36. Jane had a dream to complete an Ironman triathlon. The race consists of a 2.4-mile swim, a 112-mile bike ride, and a marathon run of 26.2 miles. In training, Jane can swim at an average pace of 1.9 mph. She rides her bike at an average of 20.8 mph, and runs at 4.1 mph. Estimate how long it will take her to complete the Ironman triathlon.

37. Because Elias is self-employed, he is advised to pay quarterly estimated federal tax payments since his income tax withholding will not fully cover next year's tax liability. Online advice instructs him to determine last year's tax, minus any withholding, and divide by four. Estimate the quarterly taxes Elias should pay if his total tax from last year was $23,741 and his total withholding was $7500.

38. Amelia is planning a road trip from Nashville, Tennessee, to Washington, D.C. The distance from Nashville to Washington is 651 miles and will take about 36 gallons of gas to complete.

a. If gas costs an average of $3.745, estimate the fuel cost for the one-way trip.

b. Use your answer for part **a.** to estimate the total cost of fuel for the round trip.

39. Debbie needs to purchase some printer paper and USB jump drives for the department where she works. Each ream of paper costs $4.55 and each pack of 4 jump drives costs $27.85. She needs nine reams of paper and six packages of jump drives. Approximate to the nearest dollar the amount of money Debbie will spend to make the purchase.

40. Marcel has decided to paint his new apartment. He estimates the cost of paint will be $385. Which estimate should Marcel use for the job so that his budget includes a contingency factor of 8% in addition to the cost of paint?

a. $38

b. $432

c. $395

d. $800

WRITING & THINKING

41. Three students estimate the product $57 \cdot 159$. Explain which of the following estimations will be the most precise and why: $50 \cdot 100$, $60 \cdot 200$, $60 \cdot 160$.

1.2 PROJECT

ESTIMATING TUNERS AND TOILETS

The physicist Enrico Fermi once asked a class of students to estimate the number of piano tuners in Chicago. We'll walk through the same estimating process that he used to solve this problem. For each step, explain your thought process for the estimate or calculation. Do not look up any values during this project. Use your reasoning skills to estimate at each step along the way.

1. Suppose the city of Chicago has approximately 3 million people living in it. From this value, estimate how many households are in Chicago. (**Hint**: First estimate how many people are in a household.)

2. Estimate how many households in Chicago own a piano. Using this estimate, determine how many pianos are likely to exist in Chicago.

3. Next, estimate how often the average piano owner has their piano tuned per year.

4. Now, consider how many pianos a single piano tuner can tune per year. Assume that it takes an hour to an hour and a half to tune a piano. (**Hint:** Would the piano tuner work every day of the year? How much travel time might the tuner need between appointments?)