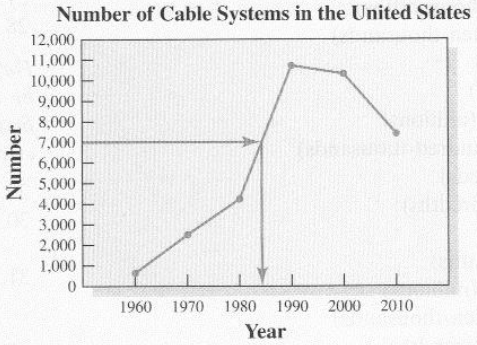
(c) This question is basically the opposite of part (a): we're given a number of distribution points (a height on the graph), and are asked to find the corresponding year. So we locate 7,000 on the vertical axis and move across to the graph, then move down to find the value on the horizontal axis.



It looks like a bit less than halfway between 1980 and 1990, so 1984 seems like a good estimate.

☑ 4. Use estimation to obtain information from graphs.

▼ Try This One 7

(a) Using the graph shown in Example 7, find the approximate number of cable distribution points in 2000.
(b) Find the average rate of change in number of distribution points from the lowest to the highest number.
(c) Estimate the year in which the number fell below 9,000 after it started to decline.

Answers to Try This One

1 (a) 372,700
(b) 33
(c) 0.371
(d) 1,465.98

2 About \$56; actual cost is more

3 About \$290

4 About \$30 per square yard

5 About 39%; about 18%

6 About 1,773

7 (a) About 10,300
(b) About 333 more distribution points per year
(c) About 2003

EXERCISE SET 1-2

Writing Exercises

1. Think of three situations in our world where you could use estimation.
2. Explain why an exact answer to a math problem isn't always necessary.
3. How can estimation be used as a quick check to see if the answer to a math problem is reasonable?
4. Describe the rules for rounding numbers to a given place.
5. Explain why there is never a single, correct answer to a question that asks you to estimate some quantity.
6. Explain how to estimate the size of a quantity from a bar graph.
7. How is information described in a pie chart? What sort of information works well with pie charts?
8. How can you tell when a quantity is getting larger over time from looking at a time-series graph?

Computational Exercises

For Exercises 9–28, round the number to the place value given.

9. 2,861 (hundreds)
10. 732.6498 (thousandths)
11. 3,261,437 (ten-thousands)
12. 9,347 (tens)
13. 62.67 (ones)
14. 45,371,999 (millions)
15. 218,763 (hundred-thousands)
16. 923 (hundreds)
17. 3.671 (hundredths)
18. 56.3 (ones)
19. 327.146 (tenths)
20. 83,261,000 (millions)
21. 5,462,371 (ten-thousands)
22. 7.8662 (thousandths)
23. 272,341 (hundred-thousands)
24. 63.715 (tenths)
25. 264.97348 (ten-thousandths)
26. 1,655,432 (thousands)
27. 482.6002 (hundredths)
28. 426.861356 (hundred-thousandths)

For Exercises 29–32, estimate the result of the computation by rounding the numbers involved, then use a calculator to find the exact value and find the percent error. (Note: percent error is equal to error/exact value, written as a percentage.)

29. $-4.21(7.38 + 3.51)$
30. $10.24(-8.93 + 2.77)$
31. $\dfrac{\sqrt{9.36}}{7.423 - 9.1}$
32. $\dfrac{47.256 - 9.90}{\sqrt{24.501}}$

Applications in Our World

33. Estimate the total cost of eight energy-saving lightbulbs on sale for $16.99 each.
34. Estimate the cost of five months of HD cable at $39.95 per month.
35. Estimate the time it would take you to drive 237 miles at 37 miles per hour.
36. Estimate the distance you can travel in 3 hours 25 minutes if you drive on average 42 miles per hour.
37. Estimate the sale price of a futon you saw on eBay that costs $178.99 and is now on sale for 60% off.
38. Estimate the sale price of a Blu-ray player that costs $42.99, on sale for 15% off.
39. Estimate the total cost of the following meal at McDonald's:

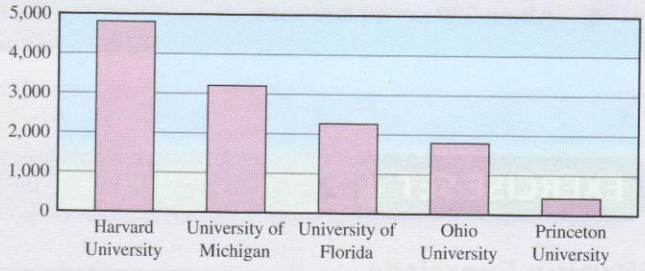
Quarter pounder with cheese	$2.89
Supersized fries	$1.89
Small shamrock shake	$1.29

40. Estimate the total cost of the following items for your dorm room:

Loft bed	$159.95
Beanbag chair	$49.95
Storage cubes	$29.95
Lava lamp	$19.95

41. A group of five architecture students enters a design for an eco-friendly building in a contest, and wins third place, with a prize of $950. Estimate how much each student will get.
42. A biology lab houses 47 rats for experiments, and they go through about 105 pounds of food each week. Estimate how much food the average rat eats per week.
43. If Erin earns $48,300.00 per year, estimate how much she earns per hour. Assume that she works 40 hours per week and 50 weeks per year.
44. If Jamaal earns $8.75 per hour, estimate how much he would earn per year. Assume that he works 40 hours per week and 50 weeks per year.
45. Estimate the cost of putting up a decorative border in your dorm room if your room is 24 feet long and 18 feet wide and the border costs $5.95 every 10 feet.
46. Estimate the cost of painting a homecoming float if the area to be painted is 12 feet by 16 feet and a quart of paint that covers 53 square feet costs $11.99.
47. The Tea Party at a large university plans to line both sides of a 30-foot-long hallway with posters endorsing a candidate for state senate. Each of the posters costs them $4.95, they're 2 feet wide, and there will be 5 feet between posters. Estimate how much this will cost.
48. Estimate your cost to live in an apartment for 1 year if the rent is $365.00 per month and utilities are $62.00 per month.

Use the information shown in the graph for Exercises 49–52. The graph gives the areas of various college campuses in acres.

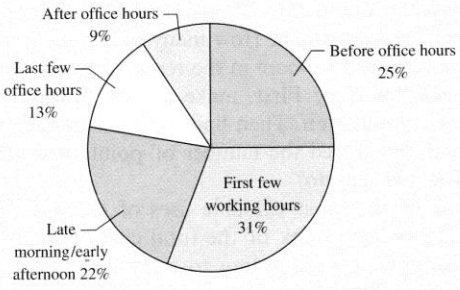


Source: http://colleges.usnews.rankingsandreviews.com

49. Estimate the area of the campus of the University of Michigan.
50. Estimate the area of the campus of Princeton University.
51. Estimate the difference between the largest campus shown and the smallest campus shown.
52. Estimate the area of each of the two universities that are approximately the same size.

Use the information shown in the graph for Exercises 53–56. The graph represents a survey of 1,385 office workers and shows the percent of people who indicated what time of day is most productive for them.

Most Productive Time of Day

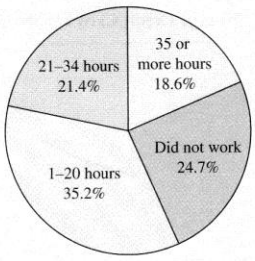


Source: USA Today

53. Estimate the number of people who feel they are most productive outside normal office hours.
54. Estimate the number of people who feel they are most productive before late morning.
55. How many more people feel they're most productive in the first few working hours compared to those that feel they're most productive in the last few office hours?
56. How many times more people are most productive before office hours compared to after?

Use the information shown in the graph for Exercises 57–60. The graph represents a survey of undergraduates enrolled in college in the 2003–2004 school year.

Hours per Week Worked by College Students Ages 22 or Younger

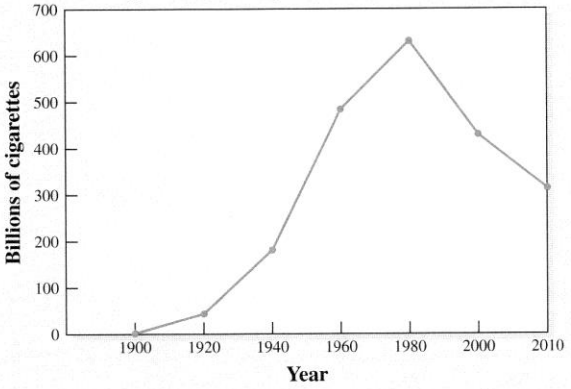


Source: www.acenet.edu

57. Approximately what percentage of students worked more than 21 hours per week?
58. Approximately what percentage of students worked less than 35 hours per week?
59. On one campus, 620 students under the age of 22 work 35 or more hours. If this student body is average in terms of work hours, about how many students of that age would you expect there to be on the entire campus?
60. In a survey at one community college, 310 respondents aged 22 or under said they don't work at all. If this student body is average in terms of work hours, about how many people would you expect were surveyed?

Use the line graph shown for Exercises 61–66. The graph shows annual cigarette consumption (in billions) for the United States for the years 1900 to 2010.

Cigarette Consumption in the United States

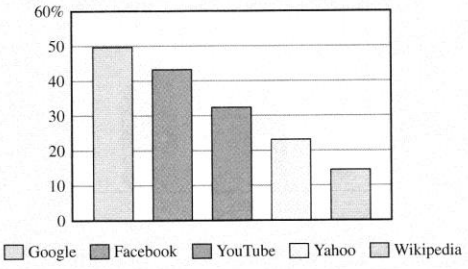


Source: www.infoplease.com

61. Estimate the number of cigarettes smoked in 1950.
62. Estimate the number of cigarettes smoked in 1985.
63. Estimate the year or years in which 200 billion cigarettes were smoked.
64. Estimate the year or years in which 400 billion cigarettes were smoked.
65. Find the average rate of change in cigarette consumption for the years shown when consumption was increasing.
66. Find the average rate of change in cigarette consumption for the years shown when consumption was decreasing.

*Use the information in the graph for Exercises 67–70. The graph shows the average daily reach for the five most visited sites on the Internet for the three-month period ending December 2, 2011. (**Reach** is the percentage of global Internet users who visit a site.)*

Average Daily Reach for Top Five Websites in the World



67. Estimate the average daily reach for Yahoo.
68. Estimate the average daily reach for YouTube.
69. Estimate the combined average daily reach for Google and Wikipedia.
70. Estimate the difference in average daily reach between the first and fifth most visited sites.