

## 9.7: Exercises

### Exercises

1. Which of the following data sets is most likely to be normally distributed? For the other choices, explain why you believe they would not follow a normal distribution.

- a) The hand span (measured from the tip of the thumb to the tip of the extended 5<sup>th</sup> finger) of a random sample of high school seniors
- b) The annual salaries of all employees of a large shipping company
- c) The annual salaries of a random sample of 50 CEOs of major companies, 25 women and 25 men
- d) The dates of 100 pennies taken from a cash drawer in a convenience store

2. The grades on a statistics mid-term for a high school are normally distributed, with  $\mu = 81$  and  $\sigma = 6.3$ . Calculate the z-scores for each of the following exam grades. Draw and label a sketch for each example. 65, 83, 93, 100

3. Assume that the mean weight of 1-year-old girls in the USA is normally distributed, with a mean of about 9.5 kilograms and a standard deviation of approximately 1.1 kilograms. Without using a calculator, estimate the percentage of 1-year-old girls who meet the following conditions. Draw a sketch and shade the proper region for each problem.

- a) Less than 8.4 kg
- b) Between 7.3 kg and 11.7 kg
- c) More than 12.8 kg

4. For a standard normal distribution, place the following in order from smallest to largest.

- a) The percentage of data below 1
- b) The percentage of data below  $-1$
- c) The mean
- d) The standard deviation
- e) The percentage of data above 2

5. The 2007 AP Statistics examination scores were not normally distributed, with  $\mu = 2.8$  and  $\sigma = 1.34$  [1]. What is the approximate z-score that corresponds to an exam score of 5? (The scores range from 1 to 5.)

- a) 0.786
- b) 1.46
- c) 1.64
- d) 2.20
- e) A z-score cannot be calculated because the distribution is not normal.

6. The heights of 5<sup>th</sup>-grade boys in the USA is approximately normally distributed, with a mean height of 143.5 cm and a standard deviation of about 7.1 cm. What is the probability that a randomly chosen 5<sup>th</sup>-grade boy would be taller than 157.7 cm?

7. A statistics class bought some sprinkle (or jimmies) doughnuts for a treat and noticed that the number of sprinkles seemed to vary from doughnut to doughnut, so they counted the sprinkles on each doughnut.

Here are the results: 241, 282, 258, 223, 133, 335, 322, 323, 354, 194, 332, 274, 233, 147, 213, 262, 227, and 366.

Create a histogram, dot plot, or box plot for this data. Comment on the shape, center, and spread of the distribution.

1. The physical plant at the main campus of a large state university receives daily requests to replace fluorescent light bulbs. The distribution of the number of daily requests is bell-shaped and has a mean of 56 and a standard deviation of 4. Using the Empirical Rule, what is the approximate percentage of light bulb replacement requests numbering between 56 and 68?

2. A company has a policy of retiring company cars; this policy looks at the number of miles driven, the purpose of trips, style of car and other features. The distribution of the number of months in service for the fleet of cars is bell-shaped and has a mean of 65 months and a standard deviation of 4 months. Using the Empirical Rule, what is the approximate percentage of cars that remain in service between 57 and 61 months?
3. The Acme Company manufactures widgets. The distribution of widget weights is bell-shaped. The widget weights have a mean of 48 ounces and a standard deviation of 11 ounces. Suggestion: sketch the distribution in order to answer these questions.
- 99.7% of the widget weights lie between \_\_\_\_\_ and \_\_\_\_\_.
  - What percentage of the widget weights lie between 26 and 81 ounces?
  - What percentage of the widget weights lie above 37?
4. For a standard normal distribution, find the following probabilities:
- $P(z < 1.42)$
  - $P(z > -2.52)$
  - $P(-2.06 < z < 2.81)$
5. For a standard normal distribution, given  $P(z < c) = 0.7055$ , find  $c$ .
6. For a standard normal distribution, given  $P(z > c) = 0.7109$ , find  $c$ .
7. On a nationwide math test, the mean was 72 and the standard deviation was 10. If Roberto scored 70, what was his z-score?
8. On a nationwide math test, the mean was 66 and the standard deviation was 4. If Roberto scored 75, what was his z-score?
9. On a nationwide math test, the mean was 57 and the standard deviation was 4. If Roberto scored 85, what was his z-score?
10. A quick survey of peanut butter prices had a standard deviation and mean of \$0.26 and \$3.68, respectively. Compute the area for a peanut butter jar costing less than \$3.50.
11. A quick survey of peanut butter prices had a standard deviation and mean of \$0.26 and \$3.68, respectively. Compute the area for a peanut butter jar costing more than \$4.25.
12. A quick survey of peanut butter prices had a standard deviation and mean of \$0.26 and \$3.68, respectively. Compute the area for a peanut butter jar costing between \$3.50 and \$4.25.
13. A quick survey of peanut butter prices had a standard deviation and mean of \$0.81 and \$3.22, respectively. Compute the price for a peanut butter jar costing given the area from the mean is 0.48422.
14. A quick survey of peanut butter prices had a standard deviation and mean of \$1.53 and \$2.22, respectively. Compute the price for a peanut butter jar costing given the area from the mean is 0.13683.
1. Which of the following intervals contains the middle 95% of the data in a standard normal distribution?
- $z < 2$
  - $z \leq 1.645$
  - $z \leq 1.96$
  - $-1.645 \leq z \leq 1.645$
  - $-1.96 \leq z \leq 1.96$
2. The manufacturing process at a metal-parts factory produces some slight variation in the diameter of metal ball bearings. The quality control experts claim that the bearings produced have a mean diameter of 1.4 cm. If the diameter is more than 0.0035 cm too wide or too narrow, they will not work properly. In order to maintain its reliable reputation, the company wishes to ensure that no more than one-tenth of 1% of the bearings that are made are ineffective. What would the standard deviation of the manufactured bearings need to be in order to meet this goal?
3. Suppose that the wrapper of a certain candy bar lists its weight as 2.13 ounces. Naturally, the weights of individual bars vary somewhat. Suppose that the weights of these candy bars vary according to a normal distribution, with  $\mu = 2.2$  ounces and  $\sigma = 0.04$  ounces.

- a) What proportion of the candy bars weigh less than the advertised weight?
  - b) What proportion of the candy bars weight between 2.2 and 2.3 ounces?
  - c) A candy bar of what weight would be heavier than all but 1% of the candy bars out there?
  - d) If the manufacturer wants to adjust the production process so that no more than 1 candy bar in 1000 weighs less than the advertised weight, what would the mean of the actual weights need to be? (Assume the standard deviation remains the same.)
  - e) If the manufacturer wants to adjust the production process so that the mean remains at 2.2 ounces and no more than 1 candy bar in 1000 weighs less than the advertised weight, how small does the standard deviation of the weights need to be?
4. The Acme Company manufactures widgets. The distribution of widget weights is bell-shaped. The widget weights have a mean of 51 ounces and a standard deviation of 4 ounces. Use the Empirical Rule to answer the following questions.
- a) 99.7% of the widget weights lie between what two weights?
  - b) What percentage of the widget weights lie between 43 and 63 ounces?
  - c) What percentage of the widget weights lie above 47?

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