

Investigation 2

ACE

Assignment Choices

Problem 2.1

Core 1–4

Problem 2.2

Core 5–7, 10, 13

Other *Extensions* 14; unassigned choices from previous problems

Problem 2.3

Core 8, 11

Other unassigned choices from previous problems

Problem 2.4

Core 12

Other *Applications* 9, *Extensions* 15; unassigned choices from previous problems

Adapted For suggestions about adapting Exercise 8 and other ACE exercises, see the *CMP Special Needs Handbook*.

Connecting to Prior Units 11, 12: *Bits and Pieces I*

Applications

1. A
2. H
3. 26 students; you can count the number of leaves on the stem plot. Each value represents one student.
4. Answers will vary. Students may find the median, which is 18.5 min. They may offer other alternatives as well; however, they must provide clear reasoning for their responses.

5. Student Ages

6	8
7	3 6 8
8	0 1 2
9	0 9
10	1 1 3 5 8
11	3 4
12	0 0 9
13	2 2 2 8
14	0 4 5 6 8 9
15	2

Key: 7 | 6 means 76 months

6. 6.7 to 7.4 yr, or about $6\frac{1}{2}$ to $7\frac{1}{2}$ yr; divide the number of months by 12 to convert to years.
7. $113\frac{1}{2}$ mo (about $9\frac{1}{2}$ yr); there are 30 data values, so the median is the value halfway between the fifteenth and sixteenth values (113 and 114).

8. a. (Figure 2)

b. You can locate the youngest student (the furthest to the left on the horizontal axis) and the shortest student (the closest to the bottom on the vertical axis). You can quickly see that the youngest student is the shortest student.

c. In general, as students get older, their heights increase.

d. People stop growing in their late teens or early twenties. The graph would level out at this time, and we would not see much increase afterward.

9. a. The graph indicates that, in general, taller people have longer foot lengths. However, knowing a person's foot length will not definitively tell you that person's height.

b. The median height is 141 cm. (NOTE: If students use the table they will find a median height of $139\frac{1}{2}$ cm. This is because the graph takes the heights of only

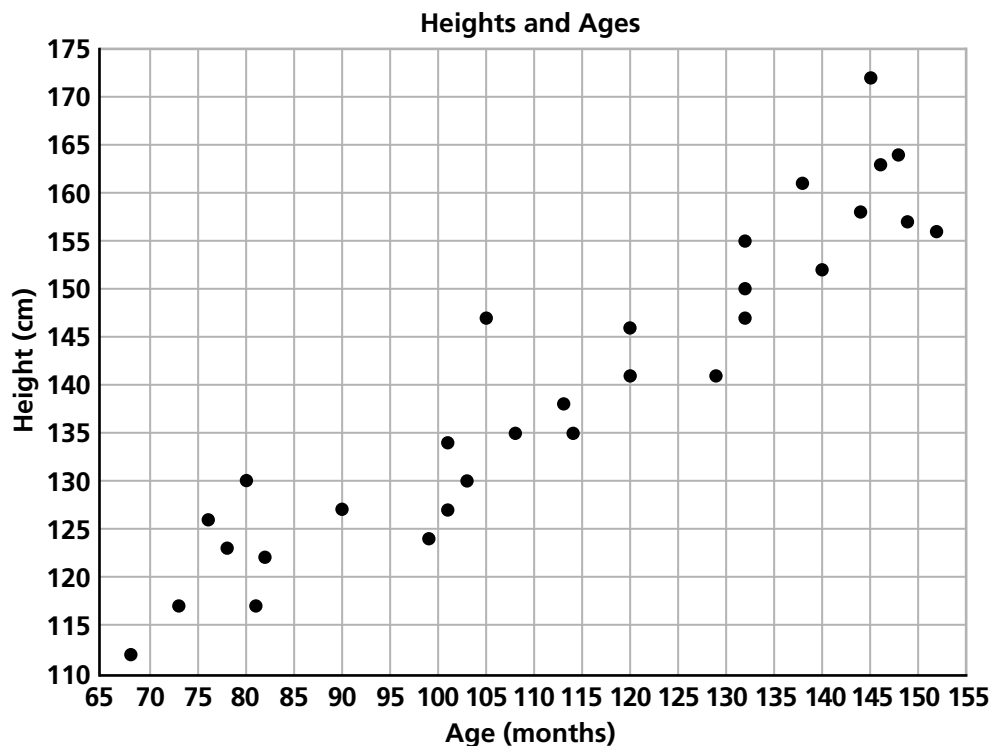
29 students out of the 30 students on the table. Only one student with the height of 127 cm and the foot length of 21 cm is represented on the graph). The median foot length is 22 cm. Dividing 141 by 22, we see that the median height is a little more than 6.4 times the median foot length.

c. Answers will vary. Height is generally about 6 to $6\frac{1}{2}$ times foot length.

d. The answers to parts (b) and (c) show that a person's height is generally 6 to $6\frac{1}{2}$ times his or her foot length, so we can use foot length to estimate height. However, we cannot know the exact height for certain.

e. If you started the graph at 0, the data points would be shifted horizontally to the right about 20 spaces and vertically upward about 14 spaces. There would be no data points in the lower left-hand region of the graph.

Figure 2



Connections

10. a. Student Heights

11	2 7 7
12	2 3 4 6 7 7
13	0 0 4 5 5 8
14	1 1 6 7 7
15	0 2 5 6 7 8
16	1 3 4
17	2

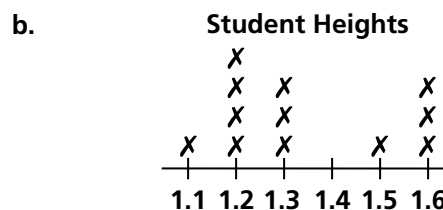
Key: 13 | 5 means 135 centimeters

- b. The least value is 112, and the greatest value is 172. These points give us the endpoints with which you can begin and end your line plot. To complete your line plot, put an X over each value in the line plot that is found in the data.
- c. The least value is 112, and the greatest value is 172. These values give us the endpoints with which you can begin and end your bar graph. To complete your bar

graph, make a bar over each value in the bar graph whose height aligns with the frequency of those values.

- d. By making a stem-and-leaf plot, you do not have to draw a bar for each height, so the stem-and-leaf plot is more compact.

11. a. (Figure 3)



- c. Some students may say that the median of 1.3 meters is typical.
12. a. 8 hours
- b. 75%; according to the pie chart, Harold spends about 2 hours on math, 2 hours on science, and 2 hours on history. So he spends $2 + 2 + 2$, or 6 out of 8 hours on those subjects altogether. $\frac{6}{8} = 75\%$

Figure 3

Student Heights and Foot Lengths

Age (mo)	Height (cm)	Height (m)	Rounded Height (tenth of a meter)	Foot Length (cm)	Foot Length (m)
76	126	1.26	1.3	24	0.24
73	117	1.17	1.2	24	0.24
68	112	1.12	1.1	17	0.17
78	123	1.23	1.2	22	0.22
81	117	1.17	1.2	20	0.20
82	122	1.22	1.2	23	0.23
80	130	1.30	1.3	22	0.22
90	127	1.27	1.3	21	0.21
138	161	1.61	1.6	28	0.28
152	156	1.56	1.6	30	0.30
149	157	1.57	1.6	27	0.27
132	150	1.50	1.5	25	0.25

Extensions

13. The graph below (Figure 4) uses G and B in place of actual numbers of jumps (refer to earlier stem plot for numbers), giving girls' and boys' data on the same plot. Students will have made separate plots, but you may use this summary graph as a way to show how we can modify stem plots to give different information.

Generally speaking, girls performed slightly better in Mr. Costo's class than the girls in Mrs. Reid's class. It seems as though Mr. Costo's class has three outliers for girls. One girl in

Mr. Costo's class jumped rope more times than anyone else in either class. The boys performed similarly in both classes. We can see an outlier for boys in each class.

14. One way to answer this question is to show all the girls' data on one side of the stem plot and all the boys' data on the other side, as shown below. (Figure 5)

The boys' data clusters at the lower end of the stem plot. The girls' data is spread out with more of the data showing larger numbers of jumps. So the girls did better.

Figure 4

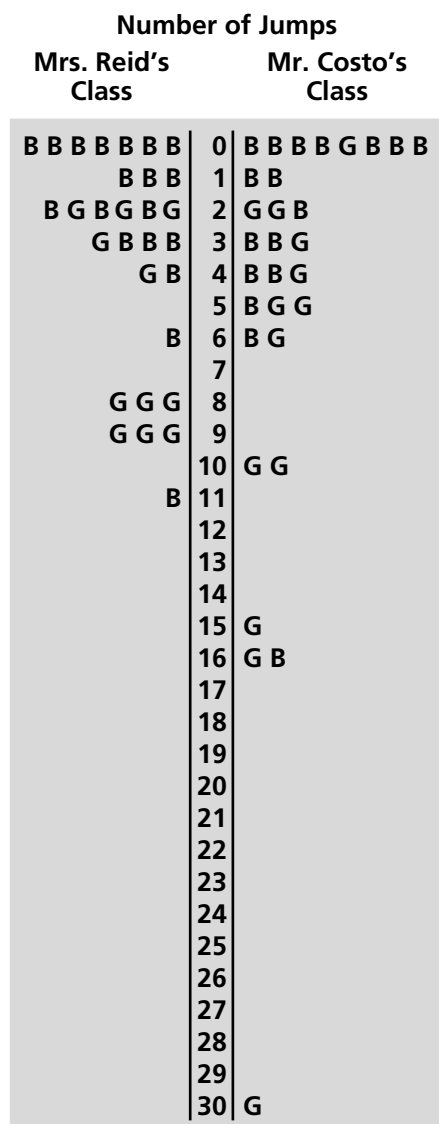
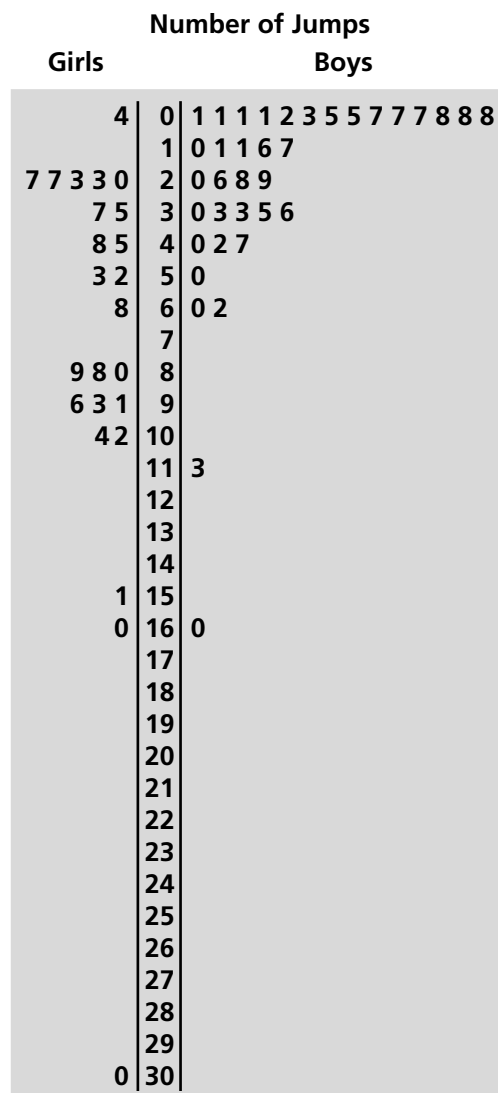


Figure 5



15. a. The actual counts vary from 309 to 607 seeds, so the range is 298 seeds. The graph shows that the actual counts fall within a smaller range compared to the guesses. The median is $458\frac{1}{2}$ seeds (halfway between 455 and 462).
- b. The guesses vary from 200 to 2,000 seeds, so the range is 1,800 seeds. The graph shows that the guesses are much more spread out than the actual counts. The median is $642\frac{1}{2}$ seeds (halfway between 630 and 655).
- c. (Figure 6)
- d. Points on or near the line represent guesses that are very close or equal to the actual counts.
- e. Points above the line represent guesses that are larger than the actual counts.
- f. Points below the line represent guesses that are smaller than the actual counts.
- g. In general, the guesses are larger than the actual counts. The median for the guesses is $642\frac{1}{2}$ with a range of 1,800 seeds. The median of the actual counts is $458\frac{1}{2}$ with a range of 298 seeds. The median for the actual counts is much smaller than the

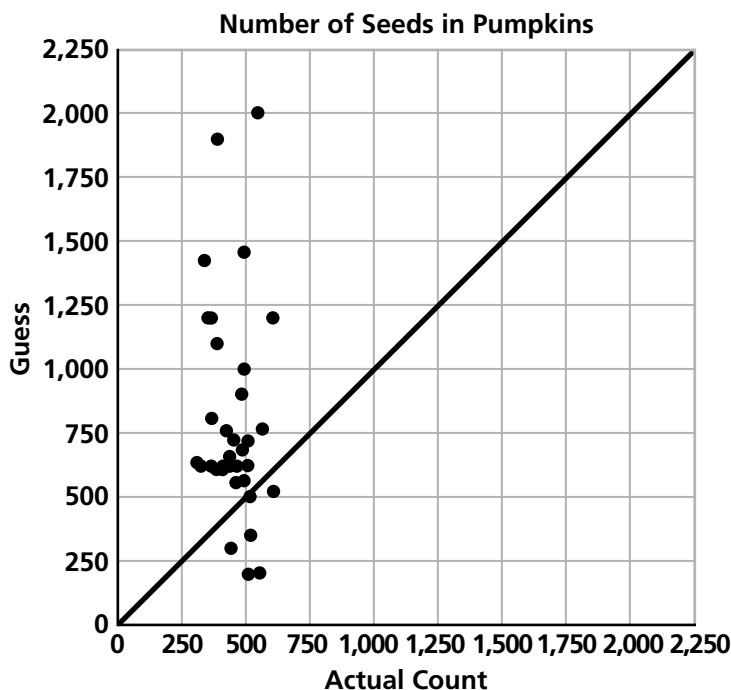
median for the guesses. The range for the guesses spans $1,800 \div 298$, or about 6 times as many values.

- h. Possible answer: You could change the scale on the horizontal axis to go from 0 to 750 scaling by 100.

Possible Answers to Mathematical Reflections

- These can easily be found on the stem plot. Find the median by first determining the number of data values in the data set and then finding half of that number. For example, if there are 46 data values, the median lies between the twenty-third and twenty-fourth values. If there are 45 data values, the median is the twenty-third value. As long as you count consecutively from the least value or the greatest value, you may count from either end of the data displayed in the stem plot to locate the median. Find the range by arranging all leaves in ascending order and then finding the difference between the greatest and least values in the data set.

Figure 6



2. To place a point, start at $(0, 0)$ and move to the right, along the horizontal axis (x -axis), the number of units given by the first coordinate. Then move up, along the vertical axis (y -axis), the number of units given by the second coordinate.
3. You assign the first measure for each pair to the x -axis, and the second measure to the y -axis. Then, you consider the spread of the data as you set up the scale of each axis.
4. A stem-and-leaf plot is more useful than a line plot or bar graph for data that are spread out. For this type of data, grouping by intervals allows us to see patterns in the data. Line plots are quickly constructed graphs that can be used when you want to “sketch” a data set. If there is a great number of data items, the bar graph is a more useful tool because its vertical scale is adjustable.