

9d Answer: Convenience, Not Random

This is a convenience sample. The surveyor only selects those that happen to come out when the current survey is completed. The participants are determined by when they walk out of the theater. This is not random.

10a This is a little slanted because it doesn't tell if the number of cell phone users who get brain cancer is any greater than the number of non-cell phone users.

11 The tax rate did double. It did increase by 5 percentage points. Since the difference is 5%, that is 100% of the original tax rate. So, the tax rate increased by 100%. The only false statement is (b) *The tax rate increased by 200%*.

13 The difference in pricing is \$20. With respect to the jeans, this is $20/100 = .20$ or a 20% difference. With respect to the khakis, this is $20/80 = .25$ or a 25% difference. So the two correct answers are
The jeans cost 25% more than the khakis.
The khakis cost 20% less than the jeans.

15 In a 10 pound bag of Doug's there are 9.5 pounds of actual grass seed. In a 10 pound bag of generic there are 8 pounds of grass seed. So there is 1.5 more pounds of grass seed in a 10 pound bag. In terms of a percentage of the amount in the generic brand, this is $1.5/8 = .1875$. So the answer is Doug's grass seed contains 18.75 % more actual grass seeds than the generic brand.
This is greater than the 15% more grass seed than you might first expect.

Chapter 2

1 • mean: $\bar{x} = \frac{4 + 8 + 4 + 6}{4} = \frac{22}{4} = 5.5$

• median: First order them: 4, 4, 6, 8 and take the average of the middle two = $\frac{4+6}{2} = 5$.

• mode: The most frequently occurring value is 4.

• range: Max - Min = $8 - 4 = 4$.

• sample variance: See chart below $s^2 = 3.7$

• sample standard deviation: See chart below $s = 1.9$

| x | $x - \bar{x}$ | $(x - \bar{x})^2$ |
|-----|------------------|-------------------|
| 4 | $4 - 5.5 = -1.5$ | 2.25 |
| 4 | $4 - 5.5 = -1.5$ | 2.25 |
| 6 | $6 - 5.5 = 0.5$ | 0.25 |
| 8 | $8 - 5.5 = 2.5$ | 6.25 |
| | | 11 |

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}} = \sqrt{\frac{11}{3}} = \sqrt{3.6667} = 1.9148 \rightarrow 1.9$$

3 • mean: $\bar{x} = \frac{-1.5 + 2.8 + 3.4 - 3.5 + 7.6 - 12.1}{6} = \frac{-3.3}{6} \approx -0.55$

• median:

Ordered: -12.1, -3.5, -1.5, 2.8, 3.4, 7.6 and take the average of the middle 2 = $\frac{-1.5+2.8}{2} = \frac{1.3}{2} = 0.65$.

• mode: There is no value that occurs more than once \rightarrow **no mode**.

- range: $\text{Max} - \text{Min} = 7.6 - (-12.1) = \mathbf{19.7}$.
- sample variance: See chart below $s^2 = \mathbf{47.25}$
- sample standard deviation: See chart below $s = \mathbf{6.87}$

| x | $x - \bar{x}$ | $(x - \bar{x})^2$ |
|-------|---------------------------|-------------------|
| -12.1 | $-12.1 - (-.55) = -11.55$ | 133.4025 |
| -3.5 | $-3.5 - (-.55) = -2.95$ | 8.7025 |
| -1.5 | $-1.5 - (-.55) = -0.95$ | 0.9025 |
| 2.8 | $2.8 - (-.55) = 3.35$ | 11.2225 |
| 3.4 | $3.4 - (-.55) = 3.95$ | 15.6025 |
| 7.6 | $7.6 - (-.55) = 8.15$ | 66.4225 |
| | | 236.255 |

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}} = \sqrt{\frac{236.255}{5}} = \sqrt{47.251} = 6.873936 \rightarrow 6.87$$

5 If you look at the group with less than 5 years experience, the female average is \$24/hr and the male average is \$23/hr. If you look at the group with more than five years experience, the female average is \$32/hr and the male average is \$31/hr. In both sub-groups, the females have a higher average. The *lurking variable* is experience. Most of the people who have more than 5 years of experience are men, and those people get paid more money. It is always a little dangerous to average across categorical data and can lead to very misleading conclusions.

7a This would change everything except the median and mode. The mean would increase as would the standard deviation and variance.

7b The mean, median, and mode would remain the same. However the standard deviation and variance would increase.

7c The mean and median would drop, there would be no mode, and the standard deviation and variance would increase.

9a $z = \frac{65.5 - 69.3}{2.8} = -1.36$. Not unusual.

9b $z = \frac{70.2 - 69.3}{2.8} = 0.32$. Not unusual.

9c $z = \frac{74.0 - 69.3}{2.8} = 1.68$. Not unusual.

9d $z = \frac{78.0 - 69.3}{2.8} = 3.11$. Unusual.

11a The z -score for her height with respect to top female models is $z = \frac{71.0 - 70}{2.2} = 0.45$. So, her height is not unusual with respect to top female models.

11b The z -score for her height with respect to U.S. women is $z = \frac{71.0 - 64}{2.8} = 2.50$. So, her height is unusual with respect to U.S. women.

11c The z -score for her weight with respect to top female models is $z = \frac{115 - 115}{18} = 0.00$. So, her weight is not unusual with respect to top female models.

11d The z -score for her weight with respect to U.S. women is $z = \frac{115 - 145}{32} = -0.94$. So, her weight is not unusual with respect to U.S. women.

13 Gisele's z -score with respect to top models is $z = \frac{71.0 - 70}{2.2} = 0.45$. Tom's z -score with respect to NFL quarterbacks is $z = \frac{76.0 - 76.5}{1.8} = -0.28$. So with respect to their peers, Gisele is taller.

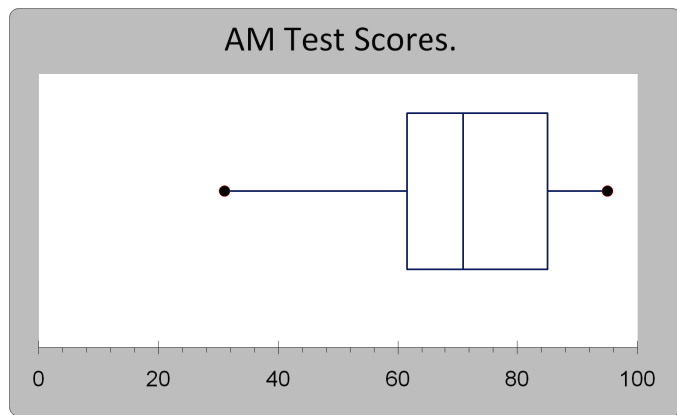
16a Yes. The z -score for the number of eggs from this particular Wolf spider is $z = \frac{500 - 302}{48} = 4.125$. This makes the number of eggs from this particular Wolf spider very unusual.

16b Perhaps my estimate was wrong. I didn't actually count the spiders and it's quite possible that when you see 300 baby spiders, you tend to over-estimate. Also, I'm not a spider expert and so it is possible that this was some other breed of spider. Or, perhaps this was a very unusual Wolf spider that laid an extraordinary number of eggs.

17(a)i $i = (90/100) \cdot 22 = 19.8 \rightarrow 20$. So P_{90} is the 20'th score = 92.

| 5-number summary | | |
|------------------|-----------|---------------------------|
| min | 31 | |
| Q_1 | 61 | $i = 5.5 \rightarrow 6$ |
| Q_2 | 71 | median |
| Q_3 | 87 | $i = 16.5 \rightarrow 17$ |
| max | 95 | |

17(a)ii



17c The morning section has a lower median (71 versus 78.5) and has the lowest minimum score (31 versus 45). The different P_{90} scores suggests it is harder to get into the top 10% of my PM section. So, the AM section seems to do worse than the PM section (Sleepy Students?). However, the middle 50% of the scores in both sections are about the same at 61 to 87 (AM) and 63 to 87 (PM). So the difference is not as drastic as you might first think.

18a Sam's GPA is calculated as a weighted average by completing the table below.

| Credits (w) | Letter Grade | Numerical Grade (x) | $w \cdot x$ |
|-----------------|--------------|-------------------------|-------------|
| 3 | B | 3.0 | 9.0 |
| 1 | A | 4.0 | 4.0 |
| 3 | C | 2.0 | 6.0 |
| 6 | D | 1.0 | 6.0 |
| 3 | A | 4.0 | 12.0 |
| 16 | | | 37 |

$$\text{GPA} = \frac{\sum(w \cdot x)}{\sum w} = \frac{37}{16} = \mathbf{2.31}$$

19 This requires a weighted average where the number of students are the weights (w 's) and the class averages are the values (x 's):

$$\bar{x} = \frac{\sum(w \cdot x)}{\sum w} = \frac{(8 \cdot 88) + (16 \cdot 74) + (30 \cdot 72)}{8 + 16 + 30} = \frac{4048}{54} = 74.923 \approx \mathbf{75}$$

| Days | Transaction | balance (x) | # days (w) | $w \cdot x$ |
|-------|-------------------|-----------------|----------------|-------------|
| 1-6 | remaining balance | \$1200 | 6 | 7200.00 |
| 7-10 | \$400 purchase | \$1600 | 4 | 6400.00 |
| 11-20 | \$300 purchase | \$1900 | 10 | 19000.00 |
| 21-30 | \$1000 payment | \$900 | 10 | 9000.00 |
| | totals | | 30 | \$41,600.00 |

average daily balance:

$$\bar{x} = \frac{\sum(w \cdot x)}{\sum w} = \frac{41600}{30} \approx \$1386.67$$

20a Within the extremely obese category, the mean weight loss by the exercise plan was 3 pounds greater than the diet plan. Within the moderately obese category, the mean weight loss by the exercise plan was again 3 pounds greater than diet plan. So, the **exercise plan** seems to be more effective.

21b Exercise Only - Weighted Average: $\bar{x} = \frac{\sum(w \cdot x)}{\sum w} = \frac{(22 \cdot 5) + (16 \cdot 25)}{30} = \mathbf{17}$

Diet Only - Weighted Average: $\bar{x} = \frac{\sum(w \cdot x)}{\sum w} = \frac{(19 \cdot 25) + (13 \cdot 5)}{30} = \mathbf{18}$

Now, it seems as the **diet plan** is better.

21c The *diet plan* had a greater number of extremely obese participants, and that category lost the most weight.

Chapter 3

1a The class midpoints are 10.5, 14.5, 18.5 ..., 30.5. The class boundaries are 12.5, 16.5, 20.5, ..., 28.5. The class width is 4.

1b Below is the histogram for the frequency distribution for MPG of American made cars.