

# Homework #3 Solutions

(20 Points and 5 Points Extra Credit)

Math 112-N

Due February 21, 2003

**Homework 5-18:** Suppose the distribution of GPA's at Jefferson High School has a mean of 2.7 and a standard deviation of 0.37 points. The GPA's at Washington High School have a mean of 2.8 and a standard deviation of 0.33 points.

- (a) Ted, a student at Washington High School, has a GPA of 3.25, and Frank, a student at Jefferson High School, has a GPA of 3.17. Calculate the  $z$ -score for Ted and Frank and comment on which of them has the higher GPA relative to his peers.

Ted's  $z$ -score is  $(3.25 - 2.8)/0.33 = 1.36$ , while Frank's  $z$ -score is  $(3.17 - 2.7)/0.37 = 1.27$ . Ted is doing better with respect to his peers than Frank is.

- (b) What GPA would Ted need to have the same  $z$ -score as Frank?

Ted would need to be 1.27 standard deviations above the mean at Washington High School, i.e., he would need to have a GPA of  $2.8 + 1.27 \times 0.33 = 3.22$ .

- (c) Torsten, another student at Jefferson High, has a GPA of 3.07. Assuming that these GPA's follow a mound-shaped distribution, approximately what proportion of Jefferson High School students have a larger GPA than Torsten?

Torsten has a GPA that is one standard deviation above the mean. 68% of the data should lie within one standard deviation of the mean, with 32% more than one standard deviation away. If the distribution is symmetric, then about 16% of the students should have GPA's more than one standard deviation above the mean, i.e., more than Torsten.

**Homework 5-19:** Suppose the average height of women collegiate volleyball players is 69 inches, with a standard deviation of 2.1 inches. Assume that heights among these players follows a mound-shaped distribution.

- (a) According to the empirical rule, about 95% of women collegiate volleyball players have heights between what two values?

$\bar{x} - 2s$  and  $\bar{x} + 2s$ , i.e., 64.8 inches and 73.2 inches.

- (b) What does the empirical rule say about the proportion of players who are between 62.7 inches and 75.3 inches?

These bounds are three standard deviations below and above the mean, and there are approximately 99.7% of the players between those bounds.

- (c) Reasoning from the empirical rule, what is the tallest we would expect a woman collegiate volleyball player to be?

The tallest value you would expect would be 75.3 inches.

**Homework 6-12:** Which states have higher percentages of female residents than others? Does one part of the country tend to have higher percentages of females than another? The table on page 130 reports the percentage of female residents in each of the fifty states, separated by states east and west of the Mississippi River.

- (a) Create a split side-by-side stemplot of the female percentages according to whether the state is east or west of the river.

Eastern		Western
	47	3
	47	
	48	
	48	
	49	11
	49	9
	50	02234
	50	5567888
431000	51	0033
887666555555	51	6889
2111000	52	

- (b) Write a paragraph commenting on similarities and differences between the eastern and western states with regard to this variable. Be sure to address whether one region tends to have a higher percentage of female residents than the other, but also comment on spread, shape, and outliers.

The eastern states tend to have a higher percentage of female residents than the western states, but the western states have a larger spread. The eastern states have a symmetric distribution, while the western states are skewed to the left, i.e., toward lower values. Alaska is an outlier for the western states, while the eastern states have no outlier.

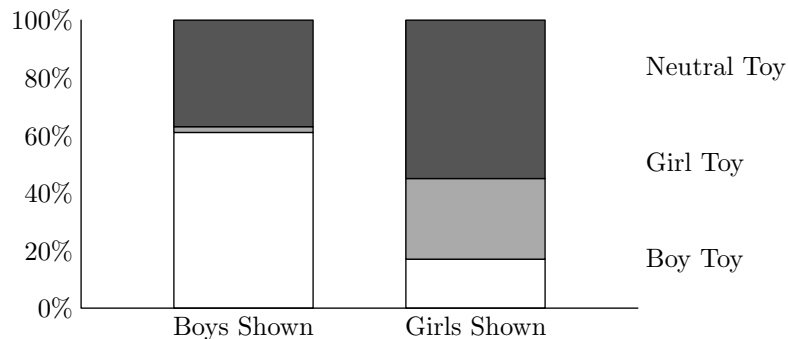
- (c) Which state is an obvious outlier? What percentage of its residents are female? Suggest a plausible explanation for this unusual percentage.

Alaska is an outlier, possibly because of being settled originally by miners and fishermen at a time when those professions were male-dominated.

**Chapter 7, Homework 7-8:** To study whether toy advertisements tend to picture children with toys considered typical of their gender, researchers examined pictures of toys in a number of children’s catalogs. For each picture, they recorded whether the child pictured was a boy or girl. (We will ignore ads in which boys and girls appeared together.) They also recorded whether the toy pictured was a traditional “male” toy (like a truck or a toy soldier) or a traditional “female” toy (like a doll or a kitchen set) or a “neutral” toy (like a puzzle or a toy phone). Their results are summarized in the following two-way table:

	boy shown	girl shown
traditional “boy” toy	59	15
traditional “girl” toy	2	24
neutral gender toy	36	47

- (a) Calculate the marginal totals for the table.  
 The number of boys shown is 97. The number of girls shown is 86. The number of traditional “boy” toys shown is 74. The number of traditional “girl” toys shown is 26. The number of neutral gender toys shown is 83.
- (b) What proportion of the ads showing *boys* depicted traditionally male toys? traditionally female toys? neutral toys?  
 59 out of the 97 ads showing boys shown showed male toys, or 61%. 2 out of the 97 ads showing boys shown showed female toys, or 2%. 36 out of the 97 ads showing boys shown showed neutral toys, or 37%.
- (c) Calculate the conditional distribution of toy types for ads showing *girls*.  
 15 out of the 86 ads showing girls shown showed male toys, or 17%. 24 out of the 86 ads showing girls shown showed female toys, or 28%. 47 out of the 86 ads showing girls shown showed neutral toys, or 55%.
- (d) Construct a segmented bar graph to display these conditional distributions.



- (e) Based on the segmented bar graph, comment on whether the researchers' data seem to suggest that toy advertisers do indeed tend to present pictures of children with toys stereotypical of their gender. Given how few ads showing boys show girl toys, it seems as if there is a gender bias in toy ads.

**Chapter 7, Homework 7-9:** Reconsider the data concerning toy advertising presented in Activity 7-8. Let us refer to ads that show boys with traditionally “female” toys and ads that show girls with traditionally “male” toys as “crossover” ads.

- (a) What proportion of the ads under consideration are “crossover” ads?  
17 of the 183, or 9% of the ads are crossover ads.
- (b) What proportion of *the crossover ads* depict girls with traditionally male toys?  
15 of the 17, or 88% of the crossover ads show girls playing with boy toys.
- (c) What proportion of *the crossover ads* depict boys with traditionally female toys?  
2 of the 17, or 12% of the crossover ads show boys playing with girl toys.
- (d) When toy advertisers do defy gender stereotypes, in which direction does their defiance tend?  
Advertisers rarely show boys playing with traditionally female toys.