AE Additional Exercises

1. A carpenter is attempting to repair a porch and needs twenty boards which are eight feet long. The salesman at the hardware store says he has twenty boards that "average" eight feet long. When the carpenter checks what he has bought, there are ten boards at six feet and ten boards at ten feet. Do you feel the salesman accurately represented the lengths? Discuss.

2. The maximum heart rates achieved while performing a particular aerobic exercise routine are measured (in beats per minute) for 9 randomly selected individuals.

Maximum Heart Rates (Beats per Minute)								
145	155	130	185	170	165	150	160	125

a. Calculate the sample variance of the maximum heart rate achieved.

b. Calculate the sample standard deviation of the maximum heart rate achieved.

c. Calculate the range of the maximum heart rate achieved.

d. What are some of the factors which might contribute to the variation in the observations?

3. A sample of teenagers was asked how many times they went to the movies in the past 3 months. The frequency distribution table summarizes the results.

Teenager Movie Visits	
Number of Visits	Frequency
0	13
1	18
2	11
3	7
4	4
5	3
6	0
7	3
8	3
9	0
10	2

a. What proportion of the sample visited the movies at least 3 times in the previous 3 months?

b. Find the mean and standard deviation of the number of visits using the formulas for grouped data.

c. Compute the interval one standard deviation about the mean.

d. Find the percent of data falling in the interval one standard deviation about the mean.

e. Is the percent of the data falling in the interval one standard deviation about the mean close to what the Empirical Rule predicts? What is the reason for the discrepancy, if any?

4. A high school math teacher summarized the 35 math SAT scores for the students in her calculus class. The mean for the class was 521 and the median was 535. The range of the scores was 235 and the highest score in the entire class was 675. Approximately 40% of the class scored higher than 562. State whether each of the following is true or false.

a. The 45th percentile exceeds 540.

b. The lowest score in the class was 440.

c. The z-score for a score of 510 is a negative number.

d. The third quartile exceeds 562.

e. The percentile rank of 562 is 40.

5. Consider the following number of defective circuit boards produced by two different machines on seven randomly selected days.

Defective Circuit Boards							
Machine A	2	3	7	4	5	1	0
Machine B	2	3	4	3	4	2	4

a. Calculate the average number of defective circuit boards produced by each machine.

b. Calculate the variance of the number of defective circuit boards produced by each machine.

c. Calculate the standard deviation of the number of defective circuit boards produced by each machine.

d. Which machine do you think is better? Why?

6. A basketball coach has one remaining scholarship to offer and has narrowed his choice to two players. Listed in the following table are the points scored per game over the last season for each player.

Points Scored		
Game Number	**Braudrick**	**Douglas**
1	27	35
2	34	21
3	29	50
4	25	28
5	28	missed
6	35	32
7	31	29
8	33	missed
9	33	23
10	25	35
11	28	31
12	32	36
Total	**360**	**320**

a. What level of measurement does the data possess?

b. What statistical criteria might you use to select the better player? Justify your answer.

c. Calculate the statistics you proposed in **b.**

d. Which player is more consistent? Why?

7. Consider the literacy data given in the following table.

Literacy Rates

Country	Literacy Rate (%)	Country	Literacy Rate (%)
Australia	99.0	Luxembourg	99.0
Bolivia	90.7	Mexico	92.8
Canada	99.0	Netherlands	99.0
Denmark	99.0	Peru	89.6
France	99.0	Saudi Arabia	85.0
India	74.0	United States of America	99.0
Kenya	73.0	Zimbabwe	91.2

Source: United Nations Development Programme Report, 2009

a. What is the mean literacy rate for these selected countries?

b. What is the standard deviation of these literacy rates?

c. How many countries in this group would we expect to have literacy rates between one standard deviation below the mean and one standard deviation above the mean?

d. How many countries in this group actually have literacy rates between one standard deviation below the mean and one standard deviation above the mean?

e. What assumption did you make in answering part **c.** above?

8. A manufacturer considers her production process to be "in control" if the proportion of defective items is less than 3%. She randomly selects 200 items and determines that 9 of the items are defective.

a. Calculate the sample proportion of defective items.

b. Based on the sample, do you think it is reasonable for the manufacturer to conclude that the production process is "out of control"? Why or why not?

9. A pharmacist is interested in studying the relationship between the amount of a particular drug in the bloodstream (in mg) and reaction time (in seconds) of subjects taking the drug. Ten subjects are randomly selected and administered various doses of the drug. The reaction times (in seconds) are measured 15 minutes after the drug is administered with the following results.

Reaction Times

Amount of Drug (mg)	Reaction Time (Seconds)
1	0.5
2	0.7
3	0.6
4	0.7
5	0.8
6	0.8
7	0.9
8	0.6
9	0.9
10	1.0

a. Analyze the data collected for the study by answering the following questions:

i. Do the variables selected for measurement seem appropriate for answering the question the pharmacist is interested in?

ii. What biases or errors might be present in the data?

iii. What level of measurement (nominal, ordinal, interval, ratio) does the data possess?

b. Plot the data points on a scatterplot.

c. Based on the scatterplot in part **b.**, answer the following questions regarding the overall pattern of the data.

i. Does the pattern roughly follow a straight line?

ii. Is the pattern upward sloping or downward sloping? Are the data values tightly clustered in the pattern or widely dispersed?

iii. Are there significant deviations from the pattern?

10. Sometimes the following descriptions are assigned to the correlation coefficient.

$r = 0$	no linear relationship
$-0.5 < r < 0$	weak negative linear relationship
$0 < r < 0.5$	weak positive linear relationship
$-0.8 < r \leq -0.5$	moderate negative linear relationship
$0.5 \leq r < 0.8$	moderate positive linear relationship
$-1.0 < r \leq -0.8$	strong negative linear relationship
$0.8 \leq r < 1.0$	strong positive linear relationship
$r = 1$	exact positive linear relationship
$r = -1$	exact negative linear relationship

Describe the relationships indicated by the correlation coefficients below using the descriptions defined above.

a. $r = 0.9$ **c.** $r = -0.9$ **e.** $r = 0$

b. $r = 0.5$ **d.** $r = -0.5$

11. Describe the relationships indicated by the correlation coefficients below using the descriptions defined in problem 10 above.

a. $r = 0.8$ **c.** $r = -0.8$ **e.** $r = 0.1$

b. $r = 0.4$ **d.** $r = -0.4$

12. Consider the following data.

x	1	2	3	4	5	6	7
y	1	4	9	16	25	36	49

a. Plot the data points on a scatterplot.

b. Determine the correlation coefficient.

c. Describe the relationship between x and y.

13. Consider the following data.

x	1	2	3	4	5	6	7
y	1.00	1.41	1.73	2.00	2.24	2.45	2.65

a. Plot the data points on a scatterplot.

b. Determine the correlation coefficient.

c. Describe the relationship between x and y.