Math 10 - Exercises for Lecture 3

Sample Exam Question

Suppose you are given a set of data: $X_1 = 10$, $X_2 = 20$, $X_3 = 30$, $X_4 = 110$, $X_5 = 130$, $X_6 = 300$.

1. Calculate the mean and median of this set of data. Show your work. (2 points)

2. Give a short reason why the mean and the median are the same, or why they are not the same. (1 points)

3. The population variance of this set of data is around 10067. You are told that after applying a linear transformation $Y_i = aX_i - b$ to the data, the population variance of the set of Y_is is around 40268. What is the value of $a > 0$ in the linear transformation? (1 points)

4. If we convert our set of data and its transformation in question 3 into a set of bivariate data (X_i, Y_i), what would the correlation coefficient r be? Explain your answer. (2 points)

5. Suppose we convert our set of data and its transformation in question 3 into a set of bivariate data (X_i, Y_j) by pairing each X_i and Y_j at random. What is a good guess for how the resulting correlation coefficient r might differ from the r calculated in question 4? Why would there be or not be a difference? (2 points)

6. Suppose we apply the transformation $Z_i = \frac{1}{1000}X_i^3 + 50$ to our data. We then covert these data into a set of bivariate data (X_i, Z_i). Would the correlation coefficient be $r = 1$? Why or why not? (2 points)

7. Suppose you were given a set of bivariate data (R_i, S_i) with correlation coefficient $r = 0.65$. Suppose we change the unit of measure of R_i from inches to cm (1 inch is 2.54 cm). What would the new r be? Explain your answer. (2 points)

Answers
1) mean = 100, median = 70.
2) positively skewed. mean is affected more by large values and outliers.
can also give the balance scale argument.
3) $a = 2$.
4) $r = 1$. Perfect linear relationship.
5) r will probably be lower. Less/no correlation if randomized.
6) Will not be 1. Points will not have a perfect linear relationship.
7) New $r = 0.65$. r is not affected by change in units of measurement of one of the variables.