(Due Tuesday 01/29/2019 right before the class)

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(Your homework shall be stapled if it contains multiple pages.)

SPRING/2019/MA526: HOMEWORK 1

Instructor: Guangqu Zheng[1]; Grader: Chessa Mccalla[2]

Total points: 20

Q1 (4 points)

(1) Exercise 1.16 in textbook.

(2) Verify

$$n\bar{x}^2 + \sum_{i=1}^{n}(x_i - \bar{x})^2 = \sum_{i=1}^{n}(x_i)^2$$

where $\bar{x}$ is the sample average of $x_1, \ldots, x_n$.

Q2 (4 + 3 points) In a study conducted by the Department of Mechanical Engineering at Virginia Tech, the steel rods supplied by two different companies were compared. Ten sample springs were made out of the steel rods supplied by each company, and a measure of flexibility was recorded for each. The data are as follows:

Company A:	9.3	8.8	6.8	8.7	8.5
	6.7	8.0	6.5	9.2	7.0
Company B:	11.0	9.8	9.9	10.2	10.1
	9.7	11.0	11.1	10.2	9.6

(a) Calculate the sample mean and median for the data for the two companies.

(b) Compute the sample variance for the two companies. You may use the formula in Q1-(2).

Q2 (1 + 2 + 2 points) Fix an integer $n \geq 2$ and consider the sample $x_1, \ldots, x_n$.

(a) Recall the definition of sample average and median. Is sample median always bigger than sample average?

(b) If $f(x) = mx + c$ with $m \neq 0$ and c any given real number, then we call f a linear function. Putting $y_i = f(x_i)$, we get a new sample $y_1, \ldots, y_n$. What is the relation between the sample average of $x_1, \ldots, x_n$ and the sample average of $y_1, \ldots, y_n$?

(c) Following question (b): What is the relation between the sample variance of $x_1, \ldots, x_n$ and the sample variance of $y_1, \ldots, y_n$?

Q4 (4 points) Let Ω be our sample space in this question. It models all possible outcomes from our (imaginary) experiment, so it is a nonempty set by default. Let A, B, C be subsets of Ω, written as $A \subset \Omega$, $B \subset \Omega$ and $C \subset \Omega$. Are the following statements true or false? Justify your response carefully.

(i) If $A \subset B$, then $A^c \subset B^c$. (A^c stands for the complement of the set A.)

(ii) If $A \subset B$, then $A \cap C \subset B \cap C$.

(iii) If $A \cup C \subset B \cup C$, then $A \subset B$.

(iv) If $A \cap C \subset B \cap C$, then $A \subset B$.

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