

## Problem Set 1

ECON 340: Economic Research Methods

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1. (1 pt) Is the following statement true or false?

$$\sum_{i=1}^n (3X_i^2 + 2k) = 3 \left( \sum_{j=1}^{n-1} X_j^2 \right) + 3X_n^2 + 2nk$$

Show the work that led you to your conclusion.

2. (1 pt) Fill in the following frequency distribution table.

$X_i$	Relative Frequency	Cumulative Frequency
1		0.1
2		0.3
3	0.4	
4		
Total		X

3. (2 pts) I have data on the calorie consumption of five adults as follows:

1400, 1800, 2000, 2200, 2600

- (a) What is the *mean* calorie consumption for this group?
- (b) What is the *median* calorie consumption for this group?

Now let's say I add one more individual to the data set whose calorie consumption is 4100.

- (c) What is the *mean* calorie consumption now?
  - (d) What is the *median* calorie consumption now?
  - (e) Which of the two is more sensitive to outliers, *median* or *mean*? Why do you think that's the case?
4. (1 pt) Here is the amount (in \$) that I spent on groceries in the last three weeks:

100, 120, 80

Calculate the variance of my grocery spending during these weeks. (Write down the formula you used and then plug in the values so I can see how you calculated your answer.)

5. (3 pts) The following table is constructed from a sample of 6 students.  $X_i$  represents the number of hours an individual usually sleeps and  $Y_i$  represents the number of hours the individual typically exercises per week.

Obs	$X_i$	$Y_i$	$(X_i - \bar{X})$	$(Y_i - \bar{Y})$	$(X_i - \bar{X})^2$	$(Y_i - \bar{Y})^2$	$(X_i - \bar{X})(Y_i - \bar{Y})$
1	8	3	0.5	-1	0.25	1	-0.5
2	7	4	-0.5	0	0.25	0	0
3	6.5	2	-1	-2	1	4	2
4	7.5	4	0	0	0	0	0
5	9	6	1.5	2	2.25	4	3
6	7	5	-0.5	1	0.25	1	-0.5
<b>Total</b>	<b>45</b>	<b>24</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>10</b>	<b>4</b>

For each of the parts, write down the formula you used and then plug in the values so I can see how you calculated your answer.

- What is the variance of  $X$  and  $Y$ ?
- What is the standard deviation of  $X$  and  $Y$ ?
- How many standard deviations is the fifth observation away from the average hours of sleep?
- What is the covariance between hours of sleep per night and hours of exercise per week?
- What is the correlation between  $X$  and  $Y$ ?

6. (2 pts) We asked 1000 individuals whether they watched the movie Barbie in the theatre. We create a variable  $X_i$  that takes value 1 if the individual watched the movie in the theatre and 0 if they did not. 200 individuals said they watched it in the theatre, while 800 individuals said they didn't. Calculate the mean and variance of  $X_i$ . (Show your work.)