

MATHS AND STATISTICS PRE-ARRIVAL MODULES PRACTICE PROBLEMS

MODULE 1

1. What is the difference between a theory and a hypothesis?

2. Imagine you are a policymaker, and you have been given additional funding to improve education outcomes in your district. You could spend these funds in many different ways, but the head of your department suggests that *hiring more teachers to reduce the size of the class will improve test scores*.

Using this idea, try to develop a research question, theory, and set of hypotheses.

RESEARCH QUESTION	
THEORY	
HYPOTHESIS (H_A)	
NULL NYPOTHESIS (H_0)	

3. What is the difference between qualitative and quantitative data?

4. Given this list of data, identify which are “qualitative” and which are “quantitative.”
 - a. Election results for the past ten years
 - b. Open ended interviews
 - c. First hand accounts (such as diaries, or other primary sources)
 - d. Survey data
 - e. Newspaper reports

MODULE 2

1. What do we mean when we say “correlation does not imply causation”?
2. Suppose someone supplied you with data that showed a positive correlation between the number of nurses in a hospital (X) and the number of patient deaths (Y). They then tried to argue that increasing the number of nurses would cause an increase in deaths, and therefore nurses are bad for patient health. Using the concept of omitted variables, or any other logical reasoning, and explain why this conclusion might be wrong.
3. Imagine you are a policymaker, and you are focusing on the problem that there is low turnout in your district (as in, the number of people voting in each election has been steadily decreasing). Here, turnout is your dependent variable (Y). List as many independent variables (X) as you can that could plausibly affect turnout on the day of the election.

Y= Voter turnout

X=

- 1.
- 2.
- 3.
- 4.

MODULE 3

1. Using Tables 3.1 and 3.2, write out this expression in words:

$$\forall x \in X \text{ and } \forall y \in Y, \exists z \in Z \text{ s.t. } x + y = z,$$

2. Evaluate: $2x^2 + 3x$ for $x = 3$

3. Solve for x : $(x+4) - (x+2) = 6x$

4. Of all the countries in the world, the country of Rwanda currently has the highest proportion of female politicians serving in the national legislature.

Term	Number of Female Legislators	Total Number of Legislators
2013	49	80
2008	45	80

Using this information, answer the following questions (you may round to one decimal point):

- A. What percentage of legislators were women in 2008?
- B. What percentage of legislators were women in 2013?
- C. The number of female legislators change by how many percentage points from 2008 to 2013?
- D. What was the percentage increase in female legislators from 2008 to 2013?

MODULE 4

1. Levels of measurement are usually placed in a sequence, from weakest measurement to strongest measurement (or said in another way, from the least informative to the most informative).

Place these in order, from the least informative to most informative: *ratio*, *nominal*, *interval*, *ordinal*.

2. For each variable, provide the type of measurement:

- A. The number of citizens in a town
- B. A set of categories measuring the respondent's country (1=UK, 2=Singapore, 3=India, 4=Mexico)
- C. A "feeling thermometer", or a survey question that asks where a respondent likes a policy idea (with 1 being don't like it at all, and 10 being like it very much)

3. What does the abbreviation SD stand for?

4. For each of these terms, list whether they are a measure of central tendency or dispersion: range, mean, variance, SD, mode

5. Fill in the blank, with "large" or "small."

If the data are spread out far from the mean, the SD will be _____.

If the data are bunched tightly together around the mean, the SD will be _____.