STAT 614 - HW 2

Due: Thursday, September 17, 2020 in Blackboard (go to the Homework folder under the Homework/Classwork content area) by 11:59pm.

Instructions: Please type your solutions to these **FOUR** problems and upload the document as a pdf file in Blackboard. There is only one file to submit for this assignment.

Notes: This homework continues our discussions of study design and exploratory data analyses and reviews some probability concepts.

Problem 1

Vegetarians have fewer heart attacks than non-vegetarians of the same age and sex. One reason is that vegetarians have (on average) lower blood pressure. But does a vegetarian diet actually cause lower blood pressure? The following studies were used to explain the difference in blood pressure between vegetarians and non-vegetarians.

> **Study 1**: Surveys about diet and health were sent to a random sample of 500 adults in a northwestern city. Of the 233 respondents, those who chose to be vegetarians tended to have lower blood pressure than non-vegetarians.
>
> **Study 2**: A sample of 200 adults who are not vegetarians were recruited by newspaper advertisement to participate in a study. Blood pressure was measured in all subjects at the start of the study. Half were randomly assigned to eat a vegetarian diet and the other half were assigned to their regular diet. After a year, blood pressure was measured again in each subject and the vegetarian group had, on average, a larger decrease in their blood pressure.
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> **Study 3**: Trappist monks are strict vegetarians, while Benedictine monks follow a more standard Western diet. A study of these two groups revealed that Trappist monks have (on average) lower blood pressure than Benedictine monks.

Answer the following questions about the above studies:

(a) Which of these studies, if any, is an example of a randomized experiment?
(b) In which of these studies, if any, were subjects randomly chosen to participate?
(c) Which study provides the strongest evidence that a vegetarian diet causes lower blood pressure? Explain your reasoning.
(d) For the two remaining studies (that you did not select for part c), pick one and briefly describe why you did not select it in part c.

Problem 2

From *The Statistical Sleuth, Third Edition*, Chapter 1, problems 19 & 20. Please include a description of the method you used for problem 20.

Note: If you don't have a copy of the textbook, go to the Information area in Blackboard where the first two chapters are posted (as a very rough pdf).

Problem 3

People are classified as hypertensive if their systolic blood pressure is higher than a specified level for their age group, according to the last column of the following table. Assume systolic blood pressure is *Normally distributed* with mean and standard deviation given in the table for the age groups 1-14 and 15-44, respectively.

Age group	Mean	St. Dev	Level
1-14	105.0	4.0	115.0
15-44	124.0	9.0	140.0

(a) Sketch a graph of the distribution of systolic blood pressure for both groups (on the same plot). Label the x- and y-axes, the mean, the standard deviation, and indicate the hypertensive cut-off for each group. You may take a picture of your graph and copy-and-paste it into your homework to include it with your solution. DO NOT submit a separate image file! Paste it into your homework document (and I recommend saving your homework document as a pdf to make sure it is readable in Blackboard).

(b) What proportion of 1- to 14-year-olds are hypertensive?

(c) What proportion of 15- to 44-year-olds are hypertensive?

(d) What is the probability that a randomly select 1-14-year-old is not hypertensive?

(e) Suppose two people are selected at random from 1-14-year-old age group. What is the probability that at least one of them is not hypertensive?

(f) Suppose ten people are selected at random from 1-14-year-old age group. What is the probability that all of them is not hypertensive?

Problem 4

Find **one** scholarly article which uses **one** of a normal, Poisson, binomial, or any other distribution of interest to you.

Give the following information from your article:

(a) The full citation of the article (authors, title of article, journal name, year, volume, page #s).
(b) A brief summary of the purpose of the article based on the information in the abstract. You can quote the article but then also put the purpose in your own words.
(c) A brief summary of how the distribution is used in the article. You do not need to go into a lot of detail here. Just try to get a sense of what they are using the distribution for.
(d) How you found the article (for example, through a PubMed or Google Scholar search).
(e) Why you picked that article.

Note: The next page has an example answer to this problem to give you a sense of what I am looking for with this. (Which also means you cannot use this article for your HW solution!)

The Exponential distribution is used in:

a. Roccato A, Uyttendaele M, Membré JM. Analysis of domestic refrigerator temperatures and home storage time distributions for shelf-life studies and food safety risk assessment. Food Res Int. 2017 Jun;96:171-181. doi: 10.1016/j.foodres.2017.02.017. Epub 2017 Mar 6. Review.

b. I'll quote the article: "The aim of this study was to analyse data on domestic refrigerator temperatures and storage times of chilled food in European countries in order to draw general rules which could be used either in shelf-life testing or risk assessment." So basically, they want to understand the distribution of refrigerator temperatures and storage time of chilled foods in European countries.

c. The authors state that "[d]ata fitting showed the exponential distribution was the most appropriate distribution to describe the time that food spent at consumer's place." They further conclude that time-to-consumption should be modeled (in European markets) using an Exponential law (while refrigeration temperature distributions are normal.)

a. A search in PubMed of "exponential distribution" and "health."

b. Honestly, it was because it was about refrigerators and I've never seen an article on refrigerators before! But food safety is important area of research so that totally makes sense.