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Assignment 1

Released: 09/01/2020 Due: 09/08/2020

The objective of this homework is to identify appropriate statistical methods for given problems and apply and interpret statistical techniques.

Please show ALL your work. Scanned handwritten work is acceptable as long as it is legible. If you are using a pencil, please ensure it is dark. You may collaborate with others, but you need to turn in your own work.

Problem 1

What is the probability that we get a 5th Tuesday in a 30-day month?

Problem 2

Rolled a six-sided dice three times. Answer the following Scenarios.

a. Probability of rolling 6,6,6
b. Probability of rolling 2,3,3
c. Probability of rolling all evens

Problem 3

You have data on 100 defendants who have been on trial twice, and the verdict in each each trial. Of those, 20 were never convicted, 40 were convicted both times, 10 were convicted the first time but not the second and 30 were convicted the second time but not the first.

(a) What is the probability a defendant randomly selected from among those convicted in their first trial was convicted in their second trial?
(b) Is the outcome of the second trial independent of the outcome of the first? Explain.

Problem 4

Suppose someone develops a screening for a particular learning problem. A school district proposes conducting the screening on their entire first grade population, since interventions to correct the problem are more effective when delivered earlier. The screening produces a false negative in 1 in 25 with the condition and a false positive in 1 in 50 without the condition. One in 200 students has the condition.

(a) What is the probability a student with a negative result has the condition?
(b) What is the probability a student with a positive result has the condition?

(c) Based on these two answers, do you see any problem? If so, can you think of a reasonable solution? If so, what? After implementing your solution, what is the probability you will have incorrectly concluded a student has the problem when they in fact do not?

Problem 5

You think the probability the Gators will beat the Seminoles (in football) is 1/2 and the probability the Gators will beat the Bulldogs is 1/3. You think these are independent. You have a wager with a friend in which you will win a case of beer if the Gators beat the Seminoles and lose to the Bulldogs, two cases if the Gators beat the Bulldogs and lose to the Seminoles, and six cases if the Gators win both. If the Gators lose both, you owe her three cases.

(a) Write out the probability distribution and calculate the expected value and standard deviation of your winnings.
(b) How can both you and your friend think this bet is a good deal?

Problem 6

A 2010 Pew Research poll asked 1,306 Americans "From what you've read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades, or not?". The table below shows the distribution of responses by party and ideology, where the counts have been replaced with relative frequencies.

		Response			
		Earth is warming	Not warming	Don't Know Refuse	Total
Party and Ideology	Conservative Republican	0.11	0.20	0.02	0.33
	Mod/Lib Republican	0.06	0.06	0.01	0.13
	Mod/Cons Democrat	0.25	0.07	0.02	0.34
	Liberal Democrat	0.18	0.01	0.01	0.20
	Total	0.60	0.34	0.06	1.00

a. Are believing that the earth is warming and being a liberal Democrat mutually exclusive?
b. What is the probability that a randomly chosen respondent believes the earth is warming or is a liberal Democrat?
c. What is the probability that a randomly chosen respondent believes the earth is warming given that he is a liberal Democrat?
d. What is the probability that a randomly chosen respondent believes the earth is warming given that he is a conservative Republican?
e. Does it appear that whether or not a respondent believes the earth is warming is independent of their party and ideology? Explain your reasoning.
f. What is the probability that a randomly chosen respondent is a moderate/liberal Republican given that he does not believe that the earth is warming?

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Problem 7

Below is a table of graduates and post-graduates

	Graduate	Post Graduate
Male	19	41
Female	12	28

a. What is the probability that a randomly selected individual is a male and a graduate? What kind of probability is it (Marginal/ Joint/Conditional)

b. What is the probability that a randomly selected individual is a male?

c. What is the probability of a randomly selected individual being a graduate? What kind of probability is this?

d. What is the probability that a randomly selected person is a female given that the selected person is a post-graduate? What kind of probability is this?

Problem 8

A factory has 22 identical machines. The expected number of break downs for each machine is 1.8 per year, with a standard deviation of 1.2.

(a) What are the mean and standard deviation of the total number of breakdowns each year?
(b) If each repair costs $1,000, what are the mean and standard deviation of annual repair costs?

Problem 9

The population mean on a statistics exam is 72, with a standard deviation of 12. The population average on the class project is 95, with a standard deviation of 4. If the exam is 70% of the final grade and the project 30%, what are the mean and standard deviation of final grades?

Problem 10

The population mean score for a particular exam is 74 and the standard deviation is 9. What are the mean and standard deviation of the class average score for classes composed of 36 students randomly drawn from the population?