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Psychology 317 Exam #1
January 18, 2017

Instructions

1. Use a pencil, not a pen
2. Put your name on each page where indicated, and in addition, put your section on this page.
3. Exams will be due at 10:20!
4. If you find yourself having difficulty with some problem, go on to the rest of the problems, and return to the troublemaker if you have time at the end of the exam.
5. Leave your answers as reduced fractions or decimals to three decimal places.
6. CIRCLE ALL ANSWERS: You will lose credit if an answer is not circled!
7. Check to make sure that you have all questions (see grading below)
8. SHOW ALL YOUR WORK: An answer that appears from nowhere will receive no credit!
9. Don't Panic
10. Good luck

NOTES: A "fair coin" is a coin which, when tossed, comes up heads or tails with equal probability
A "fair die" is one that when tossed comes up any number with equal probability
A "fair deck" is a card deck in which each card has an equal probability of being drawn

Grading

Problem	Points	Grader
1a-e	25	Adam
2a-e	25	Dominic
3a-h	33	Dominic
4a-b	17	Yiyu
Total	100	

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1. Martian license plates consist of three letters followed by three digits. That is, Martian plates take the form, LLL-DDD where "L" can be any capital letter and "D" can be any digit (Martians have the same letters and digits as we do).

a) Suppose that W is defined to be all possible distinct Martian license plates. Is W finite, countably infinite, or uncountably infinite? (5 points)

Using W as defined in Part a, for each of parts b-e, do the following four things.

- Make up an example of two Sets, A and B, such that A and B have the relation that is specified in the problem part (NOTE: do not define A and B such that A =B). (2 points apiece).
- Write the simplest possible equation for expressing $p(A \cup B)$ in terms of p(A) and/or p(B) and/or $p(A \cap B)$. (1 point apiece).
- State whether $p(A \cup B)$ equals 0.0, equals 1.0, or equals something between 0.0 and 1.0 (1 point apiece) **note that you need not calculate the exact probability.**
- State whether $p(A \cap B)$ equals 0.0, equals 1.0, or equals something between 0.0 and 1.0 (1 point apiece). **note that you need not calculate the exact probability.**

b) A and B are mutually exclusive but not mutually exhaustive

c) A and B are mutually exhaustive but not mutually exclusive

d) A and B are both mutually exclusive and mutually exhaustive

e) A and B are neither mutually exclusive nor mutually exhaustive

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2. Suppose that I throw two fair coins: a nickel, and a dime, then I draw a card from a standard, shuffled deck. Of interest is how the nickel comes up (i.e., H or T), how the dime comes up (i.e., H or T) and the card's suit—diamonds or not diamonds (i.e., D or not-D). You may assume that the two coin flips and the card draw are all mutually independent.

Compute the probabilities of the following outcomes (5 points apiece)

a) the nickel comes up Heads (event NH)

b) the card comes up a not-Diamond (event not-D)

c) the nickel comes up Heads given that the card is a Diamond

d) the nickel comes up Heads or the card comes up a not-Diamond (or both)

e) the nickel comes up Heads, the dime comes up Tails, and the card is a not-Diamond

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3. Consider the set of all 400 animals in Frank's Adorable Petting Zoo.

The 400 animals are divided by species as follows: 90 are Birds (Set B), 100 are Reptiles (Set R), and the remaining animals are Mammals (Set M). Assume that Sets B, R, and M are mutually exclusive and exhaustive.

All animals are also either herbivores (Set H) or carnivores (Set C). Assume that H and C are also mutually exclusive and exhaustive. There are 100 carnivores in all. Twenty of the 100 carnivores are mammals and 10 of the 100 carnivores are birds.

a) Represent this situation in a 3 columns (B, R, M) x 2 rows (H, C) contingency table in the space below. Include probabilities only in your contingency table. (12 points)

   HINT: It may be worth your while to make an initial contingency table with frequencies.

Problem 3 continues on the next page

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Suppose that you pick a random animal from Frank's Adorable Petting Zoo. Based on your contingency table, compute the following probabilities (3 points apiece).

b) $p(M)$

c) $p(\overline{H \cup B})$

d) $p(B|C)$

e) $p(B \cup C)$

f) $p(H \cap (B \cup C))$

g) $p(H|B \cup C)$

h) $(p(H|(H \cap B))$

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4. Suppose that **1%** of a population has AIDS.

Suppose that an AIDS test is developed. After the test is administered to a person, it either shows positive (P) indicating that the person has AIDS or it shows negative (N) indicated that the person does not have AIDS.

The test has the following error rates

- A person without AIDS tests positive with a probability equal to **0.02500**.
- A person with AIDS tests negative with a probability equal to **0.02000**.

a) Use appropriate notation to represent the information provided above using standard kinds of probability notation (i.e., involving unconditional probabilities, conditional probabilities, complements, unions, intersections, whatever is appropriate). Write any probabilities to **5 decimal places**. (6 points)

b) Suppose that a random person from the population tests positive. What is the probability that this person has AIDS? Write any probabilities to **5 decimal places**. Be sure to show how you got your answer. (11 points)