

Philosophy 12: Introduction to Causal Reasoning
Midterm #2

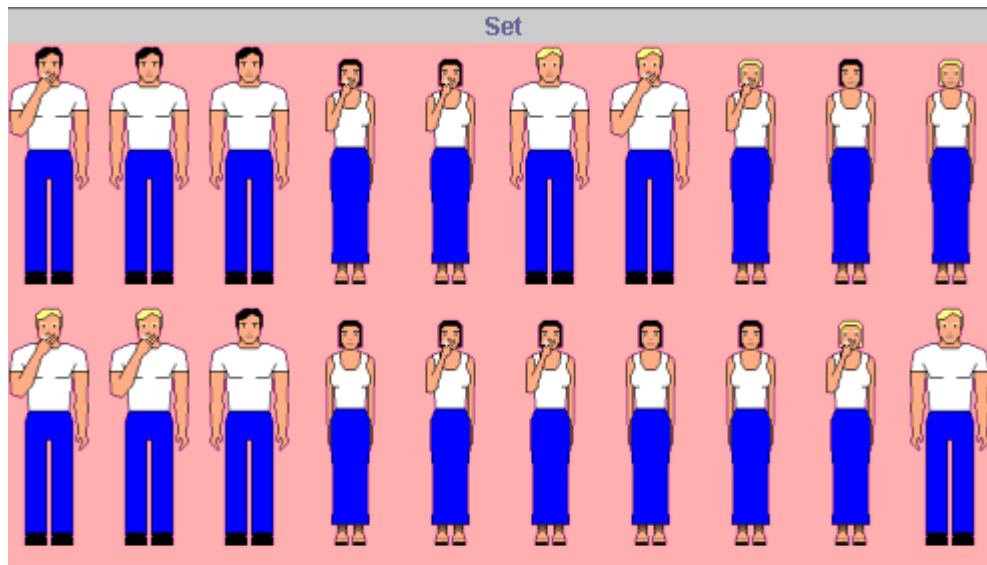
Name _____

Student ID: _____

This is a closed-book test. The first part consists of 20 multiple choice questions, each of which has only one correct answer. The second part consists of four short answer questions. Please answer the 20 multiple choice questions on your scantron, and the four short answer questions in your blue book.

Part 1: Multiple Choice (4 points each)

Consider the following population:



1. What is the relative frequency of blond males?
 - (a) 5/9
 - (b) 5/20
 - (c) 9/20
 - (d) 8/20

2. What is $\text{Fr}(\text{SMOKER} = \text{yes} \mid \text{SEX} = \text{male})$?
 - (a) 4/20
 - (b) 9/9
 - (c) 4/9
 - (d) 9/20

Consider the following contingency table:

Contingency Table of EVER ARRESTED vs. SEX

Group	Male	Female
Arrested Before	34	10
Not Arrested Before	146	170

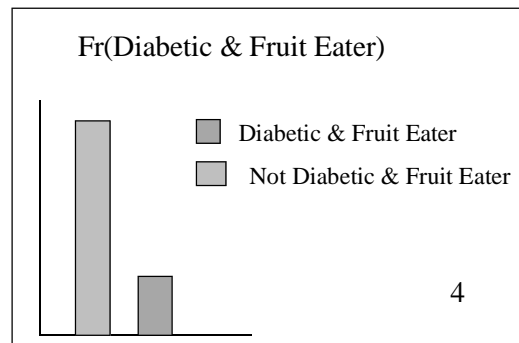
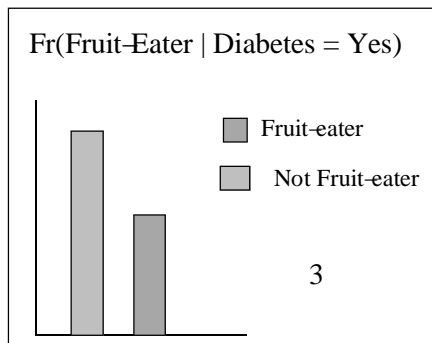
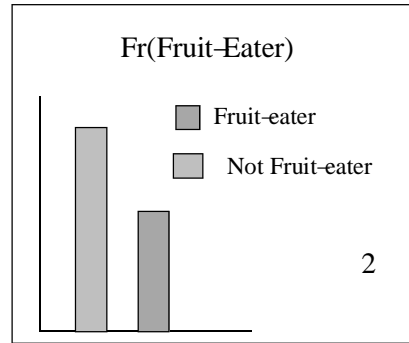
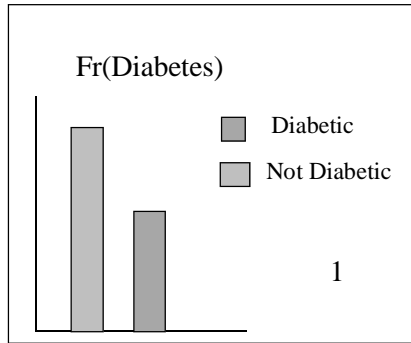
3. What is the relative frequency of people who have been arrested at least once?
 - (a) $34/44$
 - (b) $44/180$
 - (c) $10/180$
 - (d) $44/360$

4. According to this contingency table:
 - (a) Being male is independent of having been arrested before.
 - (b) Being male is associated with having been arrested before.
 - (c) Being female is independent of having been arrested before.
 - (d) There is not enough information in this contingency table to tell.

5. If A and B are properties, then A is independent of B if:
 - (a) $\text{Fr}(A) = \text{Fr}(B)$
 - (b) $\text{Fr}(A) = \text{Fr}(B | A)$
 - (c) $\text{Fr}(B) = \text{Fr}(B | A)$
 - (d) $\text{Fr}(A | B) = \text{Fr}(B | A)$

6. Which of the following is an accurate translation of: "UCSD students are more likely to succeed than the average college student"?
 - (a) UCSD Student = Yes Average College Student = Yes
 - (b) Success = Yes UCSD Student = Yes
 - (c) Average College Student = Yes Succeeds = Yes
 - (d) UCSD Student = Yes Succeeds = Yes

7. You are chief scientist in a laboratory for diabetes research and you are asked whether eating fruit and having diabetes are independent. You select a large sample of young adults and record their fruit eating habits and test them for diabetes. Your research assistant provides you with the following histograms.



Which histograms must you compare to determine if eating fruit and diabetes are independent?

- (a) 1 and 2
 (b) 1 and 3
 (c) 2 and 3
 (d) 1 and 4
8. The variables DOMESTIC VIOLENCE and RACE are independent conditional on the variable LEVEL OF EDUCATION. Which of the following formulas accurately express this sentence?
- (a) $\text{DOMESTIC VIOLENCE} = \text{No} \perp\!\!\!\perp \text{RACE} = \text{Asian}$
 (b) $\text{DOMESTIC VIOLENCE} \perp\!\!\!\perp \text{EDUCATION} \mid \text{RACE}$
 (c) $\text{DOMESTIC VIOLENCE} = \text{Yes} \perp\!\!\!\perp \text{RACE} = \text{white} \mid \text{EDUCATION} = \text{High School}$
 (d) $\text{DOMESTIC VIOLENCE} \perp\!\!\!\perp \text{RACE} \mid \text{EDUCATION}$

9. Consider the variables **COMPUTER OWNER**, **STEREO OWNER**, and **COLLEGE STUDENT**. **COMPUTER OWNER** can take on the values [Computer, No computer], **STEREO OWNER** can take on the values [Stereo, No stereo], and **COLLEGE STUDENT** can take on the values [Student, Not student]. Consider the following contingency table:

	Stereo, Student	Stereo, Not student	No stereo, Student	No stereo, Not student	Totals
Computer	50	75	40	25	190
No computer	20	30	10	10	70
Totals	70	105	50	35	260

- (a) **STEREO OWNER** \perp **COMPUTER OWNER** | **COLLEGE STUDENT**
 (b) **STEREO OWNER** \perp \neg **COMPUTER OWNER** | **COLLEGE STUDENT**
 (c) **STEREO OWNER** \perp **COMPUTER OWNER**
 (d) Not enough information to tell
10. Women are more likely to get lung cancer than men. This is
 (a) A causal claim
 (b) An associational claim
 (c) Neither a causal claim nor an associational claim
 (d) Both a causal claim and an associational claim
11. President Bush believes that reducing taxes will stimulate the economy. This is
 (a) A causal claim
 (b) An associational claim
 (c) Neither a causal claim nor an associational claim
 (d) Both a causal claim and an associational claim
12. Knowing that property B is negatively associated with property A implies that:
 (a) If we *intervene* to give a particular individual property B then they will be less likely to have property A.
 (b) *Learning* that an individual has property B makes it more likely that individual has property A.
 (c) If we *intervene* to give a particular individual property B then they will be more likely to have property A.
 (d) *Learning* that an individual has property B makes it less likely that individual has property A.

13. Which of the following formulas expresses the relative frequency of property A, conditional on property B in a population S.

(a) $\text{FrS}(A|B) = \frac{|A|}{|B|}$

(b) $\text{FrS}(A|B) = \frac{|B|}{|A|}$

(c) $\text{FrS}(A|B) = \frac{|A \& B|}{|B|}$

(d) $\text{FrS}(B|A) = \frac{|B \& A|}{|B|}$

For questions 14 and 15, consider the following table:

Individual	Sex	Hair Color	Smoker?
1	Female	Blond	Yes
2	Female	Black	Yes
3	Male	Black	No
4	Male	Black	Yes
5	Female	Blond	No
6	Male	Blond	No
7	Female	Dark	No
8	Female	Blond	No

14. In this data table, what is the frequency of blond females?

- (a) 5/8
- (b) 3/8
- (c) 3/5
- (d) 4/8

15. What is the frequency of blonds among females, i.e., $\text{Fr}(\text{HAIR COLOR} = \text{blond} \mid \text{SEX} = \text{Female})$

- (a) 5/8
- (b) 3/8
- (c) 3/5
- (d) 3/4

16. Suppose that A and B are properties, and A is independent of B ($A \perp\!\!\!\perp B$). Which of the following must also be true?

- 1) $\sim A \not\perp\!\!\!\perp B$
- 2) $B \perp\!\!\!\perp A$
- 3) $\sim A \perp\!\!\!\perp B$
- 4) $\sim B \not\perp\!\!\!\perp A$

- (a) 1 and 4
- (b) 2 and 3
- (c) 1 and 3
- (d) 2 and 4

17. Suppose that A, B, and C are properties, and A is independent of B conditional on C, (that is, $A \perp\!\!\!\perp B \mid C$). Which of the following must also be true?

- 1) $\sim A \perp\!\!\!\perp B \mid C$
- 2) $B \perp\!\!\!\perp A \mid C$
- 3) $B \perp\!\!\!\perp A \mid \sim C$
- 4) $A \not\perp\!\!\!\perp B \mid \sim C$

- (a) 1 and 4
- (b) 2 and 3
- (c) 1 and 2
- (d) 2 and 4

18. Assume that EDUCATION = High School $\not\perp\!\!\!\perp$ INCOME = Low. From this claim alone, which of the following do we know:

- (a) Learning that someone has a high school education raises the chances that the person has a low income.
- (b) Learning that someone has a low income changes the chances that the person has a high school education.
- (c) Having only a high school education causes your income to be low.
- (d) People with a high school education are as likely to have a low income as someone in the general population.

19. Suppose A and B are properties. Which of the following must be true?

- (a) $\text{Fr}(A) + \text{Fr}(B) = 1.0$
- (b) $\text{Fr}(A) + \text{Fr}(\sim A) = 1.0$
- (c) $\text{Fr}(A) + \text{Fr}(B) > 1.0$
- (d) $\text{Fr}(A \ \& \ \sim A) = 1.0$

20. Consider the variable OBESITY that takes the values [Overweight, Normal weight], and the variable LIFESTYLE that consists of the exclusive values [Regular exercise, Stressful, Stationary]. Assume that $\text{Fr}(\text{Overweight}) = 0.4$, $\text{Fr}(\text{Stressful}) = 0.6$, and $\text{Fr}(\text{Overweight} \mid \text{Stressful}) = 0.4$. What is the $\text{Fr}(\text{OBESITY} = \text{Normal weight} \mid \text{LIFESTYLE} = \text{Stressful})$?

- (a) 0.6
- (b) 0.4
- (c) 0.24
- (d) Not enough information to tell

Part 2: Short Answer (5 points each)

1. Find in values for the contingency table below such that $\text{Fr}(A \mid B) + \text{Fr}(A \mid \sim B) = 1$ while $\text{Fr}(B \mid A) + \text{Fr}(B \mid \sim A) = 1$.

	B	$\sim B$
A		
$\sim A$		

2. What is the difference between causation and association? Illustrate with the following variables:
 - SIZE OF LAST SNEAKERS BOUGHT [below size 6, above size 6]
 - CURRENT READING GRADE LEVEL [below 8th grade, above 8th grade]
3. What is the difference between independence and conditional independence?
4. Suppose you collected data on the drinking habits (DRINKING [Frequent, Not Frequent]) of 300 males and females in high school. Suppose that you were interested in examining the claim that "Drinking habits don't differ by gender." Describe what steps you take to use this data to support or reject this claim. Be as specific as you can.
5. What does it mean to say that causation is asymmetric while association is symmetric?