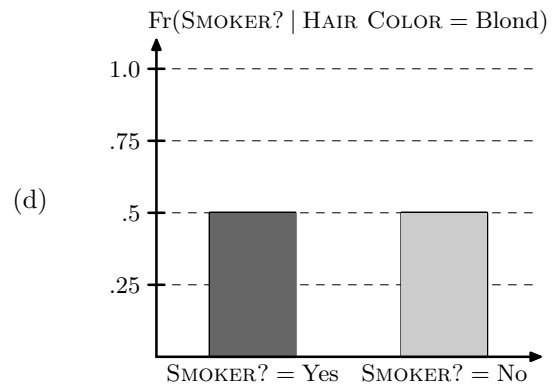
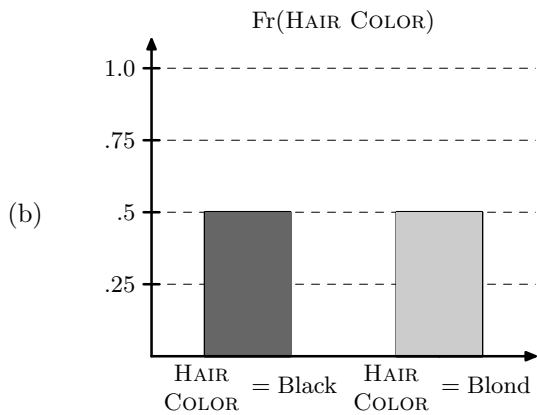
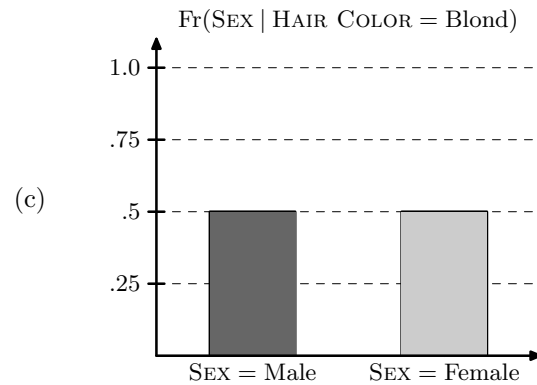
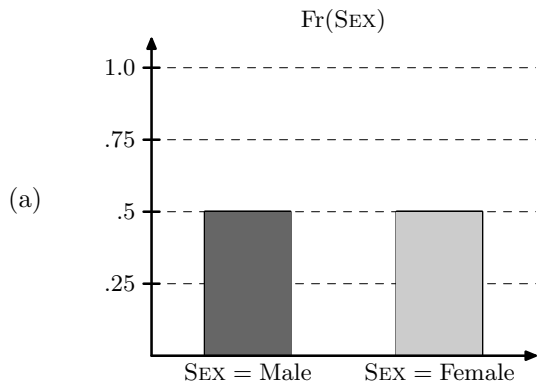


Philosophy 12: Introduction to Causal Reasoning

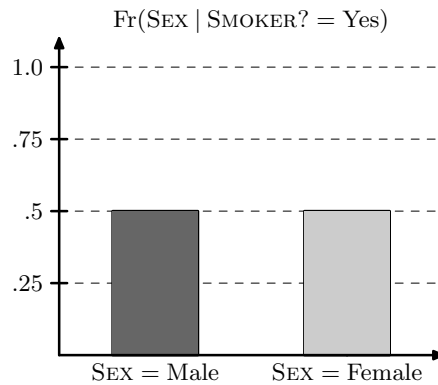
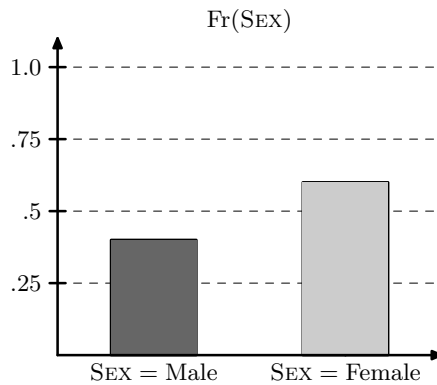
Study questions for Lecture 7: "Independence"

1. Imagine the following experiment is repeated many times: You pick a card from a shuffled deck of 52 cards that has 13 spades, 13 hearts, 13 diamonds, and 13 clubs. What is the (approximate) frequency with which your choice is a diamond?
 - (a) 0.25
 - (b) 0.13
 - (c) 0.52
 - (d) 0.4
2. Suppose again that a card is chosen from the shuffled deck, but is not shown to you. You are told, truthfully, that the card is an ace. If the procedure is repeated many times, with what frequency also a diamond?
 - (a) 0.25
 - (b) 0.13
 - (c) 0.52
 - (d) 0.4
3. When picking from a full deck, choosing an ace is independent of choosing a diamond.
 - (a) True
 - (b) False
 - (c) Not enough information to tell
4. Alternatively, suppose that you are told that the selected card is red. Now with what frequency is the chosen card a diamond?
 - (a) 0.25
 - (b) 0.13
 - (c) 0.5
 - (d) 0.52
5. Choosing a red card is independent of choosing a diamond.
 - (a) True
 - (b) False
 - (c) Not enough information to tell

6. Suppose that we want to show that being male and having blond hair are independent properties. Which charts would we need to see?



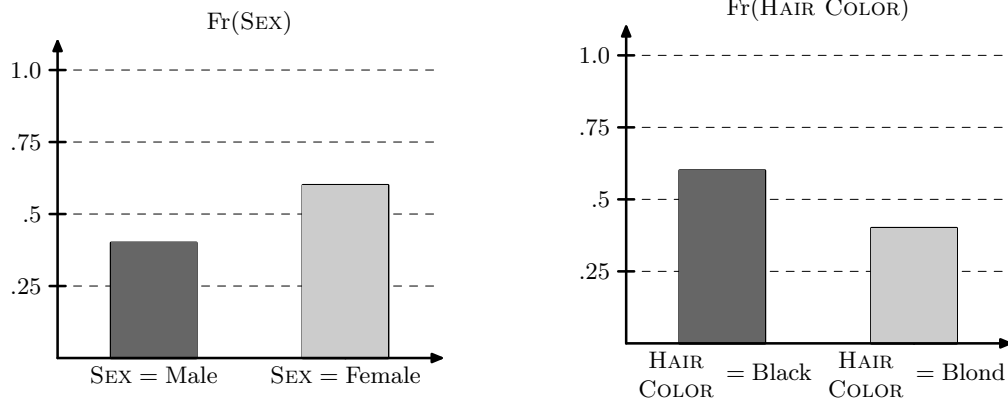
7. Consider the two histograms below:



Which of the following is true?

- (a) The properties of being male and smoking are independent.
- (b) The properties of being male and smoking are dependent.
- (c) There is not enough information in these histograms to tell whether being male and smoking are independent.

8. Consider the two histograms below:



Which of the following is true?

- (a) The properties of being male and blond are independent.
- (b) The properties of being male and blond are dependent.
- (c) There is not enough information in these histograms to tell whether being male and blond are independent.

9. What two frequencies should we compare to determine whether being male is independent of being over six feet tall?

- (a) $\text{Fr}(\text{SEX} = \text{Male})$
- (b) $\text{Fr}(\text{SEX} = \text{Male} \ \& \ \text{HEIGHT} = 6+ \text{ feet})$
- (c) $\text{Fr}(\text{SEX} = \text{Male} \ \vee \ \text{HEIGHT} = 6+ \text{ feet})$
- (d) $\text{Fr}(\text{SEX} = \text{Male} \mid \text{HEIGHT} = 6+ \text{ feet})$

10. Consider the following contingency table:

	5 FEET OR SHORTER	5-6 FEET TALL	6+ FEET TALL	Total
Male	50	250	250	550
Female	100	300	150	550
Total:	150	550	400	1100

What is the frequency of males?

- (a) $\frac{50}{150} = \frac{1}{3}$
- (b) $\frac{550}{1100} = \frac{1}{2}$
- (c) $\frac{250}{400} = \frac{5}{8}$
- (d) $\frac{400}{1100} = \frac{4}{11}$

11. What is the frequency of males among people over six feet tall?

- (a) $\frac{550}{1100} = \frac{1}{2}$
- (b) $\frac{250}{550} = \frac{5}{11}$
- (c) $\frac{150}{400} = \frac{3}{8}$
- (d) $\frac{250}{400} = \frac{5}{8}$

12. Is being male independent of being over six feet tall?

- (a) Yes
- (b) No

13. Which of the following equalities must be true if being male is independent of being blond? (Choose all that apply.)
- (a) $\text{Fr}(\text{Male}) = \text{Fr}(\text{Male} \mid \text{Blond})$
 - (b) $\text{Fr}(\text{Male}) = \text{Fr}(\text{Male} \ \& \ \text{Blond})$
 - (c) $\text{Fr}(\text{Male} \ \& \ \text{Blond}) = \text{Fr}(\text{Male}) \cdot \text{Fr}(\text{Blond})$
 - (d) $\text{Fr}(\text{Blond}) = \text{Fr}(\text{Blond} \mid \text{Male})$
14. Suppose that HANDEDNESS is a variable that takes on values $\{\text{Right-handed}, \text{Left-handed}\}$, and that HAIR COLOR is a variable with values $\{\text{Red}, \text{Black}, \text{Blond}, \text{Brown}\}$. Assume that:
- $\text{Fr}(\text{HANDEDNESS} = \text{Right-handed}) = 0.9$
 - $\text{Fr}(\text{HAIR COLOR} = \text{Red}) = 0.1$
 - $\text{Fr}(\text{HAIR COLOR} = \text{Black}) = 0.6$
 - $\text{Fr}(\text{HANDEDNESS} = \text{Right-handed} \mid \text{HAIR COLOR} = \text{Black}) = 0.9$

What is $\text{Fr}(\text{HANDEDNESS} = \text{Right-handed} \ \& \ \text{HAIR COLOR} = \text{Black})$?

- (a) 0.9
- (b) 0.81
- (c) 0.6
- (d) 0.54
- (e) Not enough information to tell

Suppose the clients of an accountant break down as follows:

INCOME	Cheats	Does not cheat	Totals
	on taxes	on taxes	
High	9	1	10
Medium	5	5	10
Low	1	9	10
Totals	15	15	30

15. The frequency of tax cheating is
- (a) $\frac{1}{3}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$
16. The frequency of tax cheating conditional on high income is:
- (a) $\frac{1}{6}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$
17. The frequency of tax cheating conditional on medium income is:
- (a) $\frac{1}{6}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$

18. The frequency of tax cheating conditional on low income is:
- (a) $\frac{1}{6}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$
19. The frequency of not tax cheating is:
- (a) $\frac{1}{6}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$
20. The frequency of not tax cheating conditional on high income is:
- (a) $\frac{1}{6}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$
21. The frequency of not tax cheating conditional on medium income is:
- (a) $\frac{1}{6}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$
22. The frequency of not tax cheating conditional on low income is:
- (a) $\frac{1}{6}$
 - (b) $\frac{1}{2}$
 - (c) $\frac{9}{10}$
 - (d) $\frac{1}{10}$
23. Which values of income are independent of not cheating on taxes?
- (a) High
 - (b) Medium
 - (c) Low
24. Which values of income are independent of tax cheating?
- (a) High
 - (b) Medium
 - (c) Low
25. Is the variable INCOME independent of the variable tax honesty?
- (a) Yes
 - (b) No
 - (c) Not enough information.

26. Consider the variables: HANDED { Right, Left }, and HAIR COLOR { Blond, Dark, Red }. The independence $\text{HANDED} = \text{Right} \perp\!\!\!\perp \text{HAIR COLOR} = \text{Dark}$ implies that: (Choose all that apply)

- (a) $\text{HANDED} = \text{Right} \perp\!\!\!\perp \text{HAIR COLOR} = \text{Blond}$
- (b) $\text{HANDED} = \text{Left} \perp\!\!\!\perp \text{HAIR COLOR} = \text{Red}$
- (c) $\text{HANDED} = \text{Left} \perp\!\!\!\perp \text{HAIR COLOR} = \text{Red}$
- (d) $\text{HANDED} \perp\!\!\!\perp \text{HAIR COLOR}$
- (e) $\text{HANDED} \perp\!\!\!\perp \text{HAIR COLOR} = \text{Dark}$

27. In a Pittsburgh study of pneumonia patients, the SEX { Male, Female } and RACE { White, Nonwhite } of approximately two thousand pneumonia patients was recorded. Are the variables SEX and RACE independent among pneumonia patients? Remember that they are independent if the frequency of a patient being male or female is the same regardless of the race of the patient.

Here is a table that gives the breakdown of SEX and RACE among 2,287 pneumonia patients in the study:

SEX	White	Nonwhite	Total
Male	972	172	1144
Female	977	166	1143
Both	1949	338	2287

Is SEX independent of RACE?

- (a) Yes
- (b) No
- (c) Not enough information to tell