# Philosophy 12: Introduction to Causal Reasoning
# Study questions for Lecture 6: "Conditional Relative Frequency"

1. Consider the following properties:

   - Property $B$: Having a beard
   - Property $F$: Being Female
   - Property $EM$: Living east of the Mississippi River

   Consider the conditional relative frequencies:

   - $\text{Fr}(B \mid F)$
   - $\text{Fr}(B \mid EM)$

   Which of the following are almost certainly true?

   (a) $\text{Fr}(B \mid F) < \text{Fr}(B)$

   (b) $\text{Fr}(B \mid EM) < \text{Fr}(B)$

   (c) $\text{Fr}(B \mid F) < \text{Fr}(B \mid EM)$

2. Consider the following statement about the relationship between Education and Income:

   > Overall, only 3% of Americans ever earn over $60,000/year. Among college graduates, however, the frequency is 11%.

   Let the variable INCOME range over the values { Over $60K/Year, Under $60K/Year } and the variable EDUCATION range over the values { College Graduate, Not College Graduate }. The statement above claims that:

   (a) Fr(EDUCATION = College Graduate) < Fr(EDUCATION = College Graduate & INCOME = Over $60K/Year)

   (b) Fr(INCOME = Over $60K/Year) < Fr(INCOME = Over $60K/Year) & Fr(EDUCATION = College Graduate)

   (c) Fr(EDUCATION = College Graduate) < Fr(EDUCATION = College Graduate | INCOME = Over $60K/Year)

   (d) Fr(INCOME = Over $60K/Year) < Fr(INCOME = Over $60K/Year | EDUCATION = College Graduate)

3. Consider the following description of the relationship between consuming garlic and speeding up recovery from colds:

> Approximately 48% of people surveyed said they recovered from their last cold in under a week. Among those who report eating garlic regularly, the proportion of early recovery was virtually no different (48.1%).

Let the variable COLD RECOVERY have the values { Recovers in over a week, Recovers in under a week } and the variable DIET have the values { Eats garlic regularly, Does not eat garlic regularly }. The statement above claims that:

(a) Fr(DIET = Eats garlic regularly) is approximately equal to Fr(DIET = Eats garlic regularly & COLD RECOVERY = Recovers in under a week)

(b) Fr(COLD RECOVERY = Recovers in under a week) is approximately equal to Fr(COLD RECOVERY = Recovers in under a week & DIET = Eats garlic regularly).

(c) Fr(DIET = Eats garlic regularly) is approximately equal to Fr(DIET = Eats garlic regularly | COLD RECOVERY = Recovers in under a week)

(d) Fr(COLD RECOVERY = Recovers in under a week) is approximately equal to Fr(COLD RECOVERY = Recovers in under a week | DIET = Eats garlic regularly).

4. Consider the following statement about the likelihood of Sally being called for jury duty.

> Given that Sally has registered to vote, the chance that she is summoned for jury duty in 2001 is 1 in 10,000.

Let the variable REGISTERED have the values { Registered to vote, Not registered to vote } and the variable JURY DUTY have the values { Called in 2001, Not called in 2001 }. The statement above claims that:

(a) Fr(REGISTERED = Registered to vote & JURY DUTY = Called in 2001) = $\frac{1}{10{,}000}$

(b) Fr(REGISTERED = Registered to vote | JURY DUTY = Called in 2001) = $\frac{1}{10{,}000}$

(c) Fr(JURY DUTY = Called in 2001 | REGISTERED = Registered to vote) = $\frac{1}{10{,}000}$.

5. Consider the following statement above sex and hair color:

> 52% of the undergraduates at UCSD are female, and 20% of the undergraduates are blond females.

Let the variable SEX have the values { Male, Female } and the variable HAIR COLOR have the values { Blond, Dark-haired }. The statement above claims that:

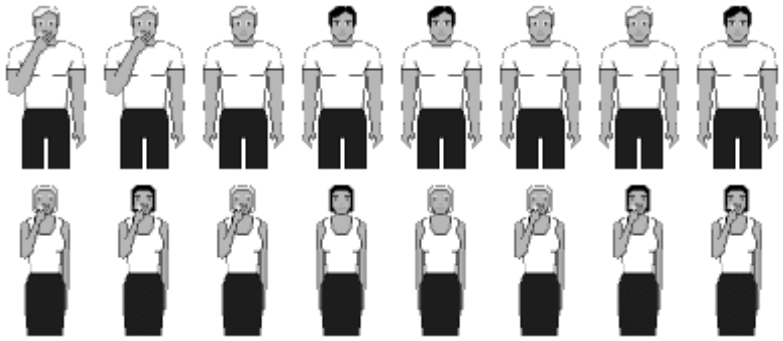
(a) Fr(SEX = Female) > Fr(SEX = Female & HAIR COLOR = Blond)

(b) Fr(HAIR COLOR = Blond) > Fr(HAIR COLOR = Blond & SEX = Female)

(c) SEX = Female) > SEX = Female | Fr(HAIR COLOR = Blond)

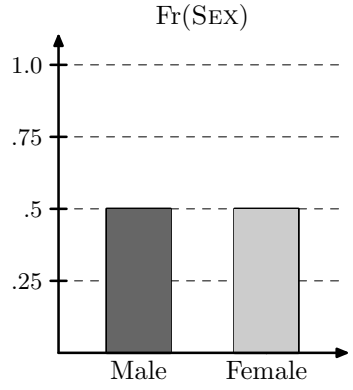
(d) Fr(HAIR COLOR = Blond) > Fr(HAIR COLOR = Blond | SEX = Female)

Use the population below to answer questions 6 through 13:

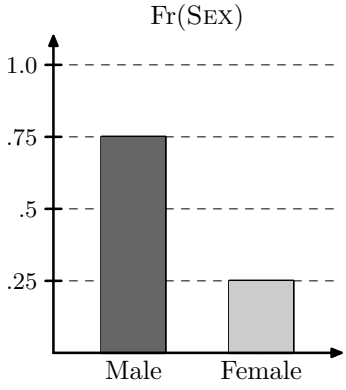


6. Fr(Sex = Male)?
   (a) 8
   (b) $\frac{5}{16}$
   (c) $\frac{8}{16}$
   (d) None of the above
7. Fr(Smokes = Smoker)?
   (a) 8
   (b) $\frac{5}{16}$
   (c) $\frac{8}{16}$
   (d) None of the above
8. Fr(Smokes = Smoker | Sex = Male)?
   (a) $\frac{2}{8}$
   (b) $\frac{2}{16}$
   (c) 2
   (d) $\frac{8}{16}$
   (e) $\frac{6}{8}$
9. Which histogram correctly represents the frequency of Sex in the sample?

(a)

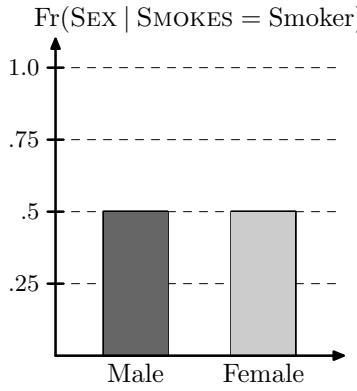



(b)

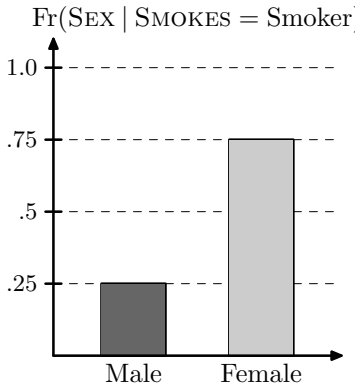


10. Which histogram correctly represents the relative frequency of SEX conditional on SMOKES = Smoker?

(a)

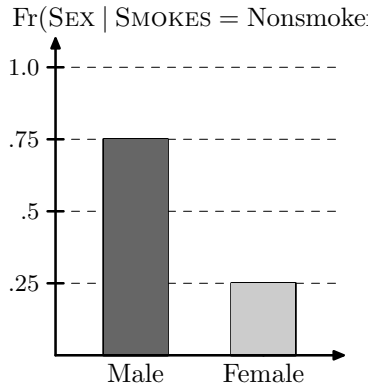



(b)

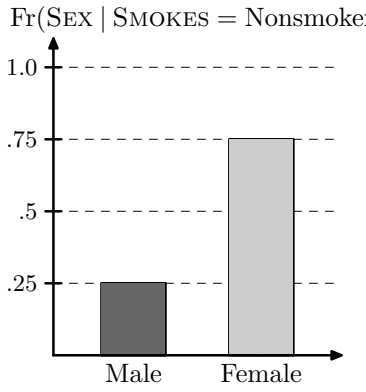



11. Which histogram correctly represents the relative frequency of SEX conditional on SMOKES = Nonsmoker?

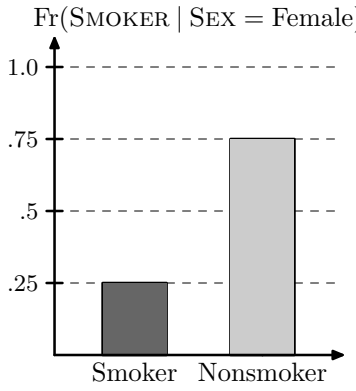
(a)




(b)



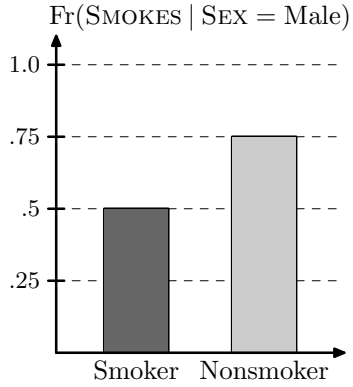

12. Does the following histogram correctly represent the relative frequency of SMOKES conditional on SEX = Female?




(a) Yes

(b) No

13. The histogram below incorrectly represents the relative frequency of SMOKES conditional on SEX = Male because




(a) The height of the bar representing Smokers is too high.

(b) The height of the bar representing Smokers is too low.

(c) The height of the bar representing Nonsmokers is too high.

(d) The height of the bar representing Nonsmokers is too low.

(e) The sum of the bar heights is too low.

(f) The sum of the bar heights is too high.

Use the following data table to answer questions 14 and 15:

| Individual | AGE | POLITICAL PARTY |
|---|---|---|
| 1 | Old | Democrat |
| 2 | Old | Republican |
| 3 | Young | Republican |
| 4 | Old | Republican |
| 5 | Young | Republican |
| 6 | Young | Democrat |
| 7 | Old | Republican |
| 8 | Young | Republican |

14. What is Fr(PARTY = Democrat | AGE = Old)?

15. What is Fr(AGE = Young | PARTY = Republican)?

Use the following contingency table to answer questions 16 through 18.

| SEX | PH.D. PLANS=Yes | PH.D. PLANS=No | Total |
|---|---|---|---|
| Male | 5 | 12 | 17 |
| Female | 6 | 5 | 11 |
| Total | 11 | 17 | 28 |

16. What is Fr(PH.D. PLANS = No | SEX = Female)?

(a) $\frac{5}{6}$

(b) $\frac{12}{17}$

(c) $\frac{5}{17}$

(d) $\frac{5}{11}$

17. What is Fr(SEX = Female | PH.D. PLANS = Yes)?

    (a) $\frac{6}{11}$
    (b) $\frac{5}{11}$
    (c) $\frac{5}{17}$
    (d) $\frac{6}{28}$
    (e) None of the above

18. What is Fr(PH.D. PLANS = Yes?

    (a) $\frac{5}{17}$
    (b) $\frac{6}{11}$
    (c) $\frac{11}{28}$
    (d) $\frac{6}{28}$
    (e) $\frac{5}{28}$
    (f) None of the above

In 1988, the Department of Highway Safety and Motor Vehicles compiled statistics on the frequency of injuries in car crashes and the frequency of seat belt use. Here is the contingency table they constructed:

| SEAT BELT | INJURY=Fatal | INJURY=Non-fatal | Total |
|---|---|---|---|
| No | 1601 | 162,527 | 164,128 |
| Yes | 510 | 412,368 | 412,878 |
| Total | 2111 | 574,895 | 577,006 |

Since the causal question at hand was whether seat belts prevent fatalities, the authors were interested in whether there was a negative association between seat belt use and fatal injuries. That is, their hypothesis was that the frequency of fatal injuries conditional on wearing a seat belt was lower than the frequency of fatal injuries in the total sample.

19. Which of the following best represents the authors' hypothesis?

    (a) Fr(SEAT BELT = Yes | INJURY = Fatal) < Fr(SEAT BELT = Yes)
    (b) Fr(SEAT BELT = Yes | INJURY = Non-fatal) < Fr(SEAT BELT = Yes)
    (c) Fr(INJURY = Fatal | SEAT BELTH = Yes) < Fr(INJURY = Fatal)
    (d) Fr(INJURY = Fatal | SEAT BELTH = Yes) < Fr(INJURY = Non-fatal)
    (e) Fr(INJURY = Fatal | SEAT BELTH = No) < Fr(INJURY = Fatal)

20. What is Fr(INJURY = Fatal)?

    (a) $\frac{2{,}111}{577{,}006}$
    (b) $\frac{1{,}601}{164{,}128}$
    (c) $\frac{510}{577{,}006}$
    (d) $\frac{510}{412{,}878}$

21. What is Fr(INJURY = Fatal | SEAT BELT = Yes)?

    (a) $\frac{1{,}601}{2{,}111}$
    (b) $\frac{1{,}601}{164{,}527}$
    (c) $\frac{510}{2{,}111}$
    (d) $\frac{510}{412{,}878}$

22. According to the data, is the hypothesis of the author correct?

    (a) Yes

    (b) No