

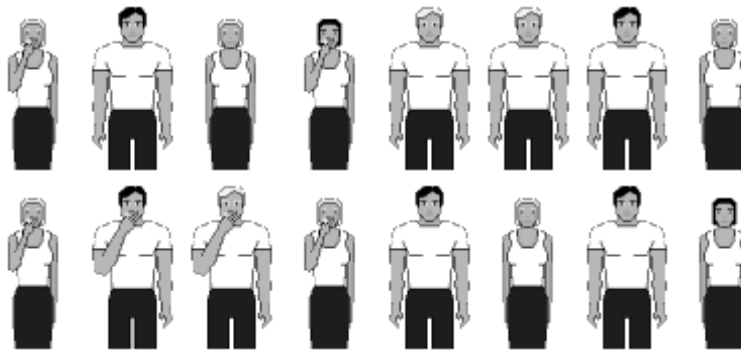
# Philosophy 12: Introduction to Causal Reasoning

## Answers to study questions for Lecture 5: "Relative Frequency"

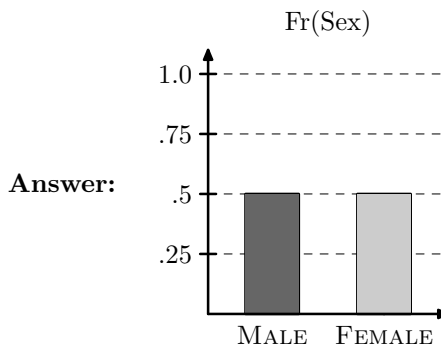
- Suppose that 1200 students were non-smokers, 800 were moderate smokers, and 400 were heavy smokers. What is the relative frequency of non-smokers? Moderate smokers? Heavy smokers?

**Answer:** The relative frequency of non-smokers is  $\frac{1200}{2400} = \frac{1}{2}$ . The relative frequency of moderate smokers is  $\frac{800}{2400} = \frac{1}{3}$  and the relative frequency of heavy smokers is  $\frac{400}{2400} = \frac{1}{6}$ .

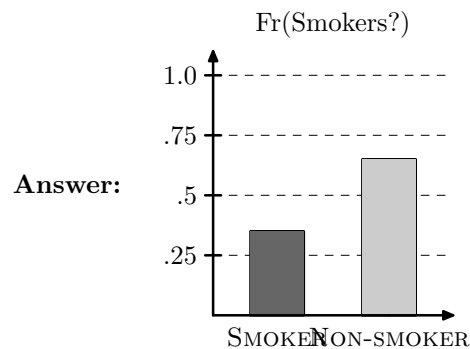
For questions 2 and 4, consider the following population of individuals (consisting of a random selection of men and women, some who smoke, with varying hair color):



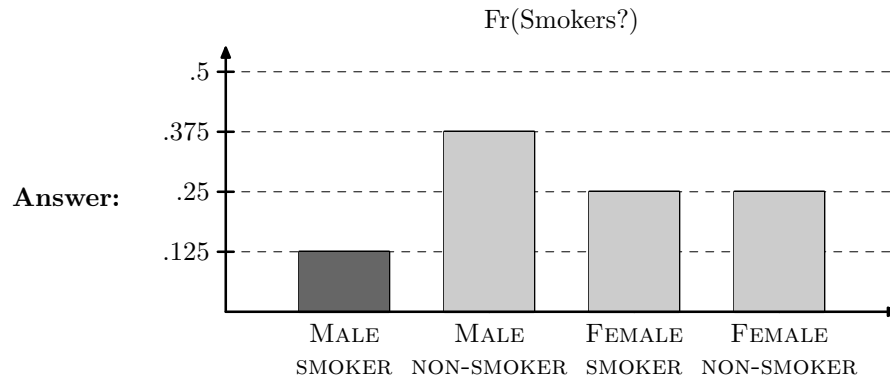
- Construct the histogram for the frequency of the variable SEX.



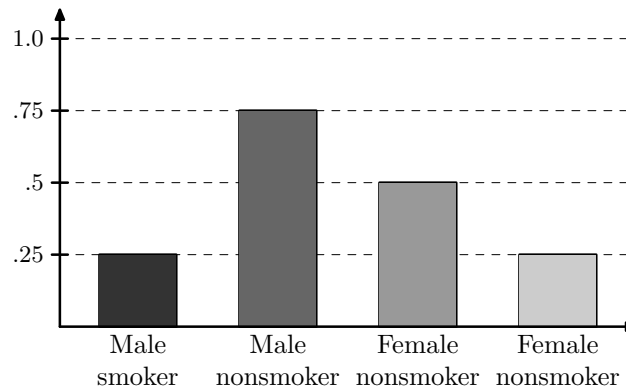
- Construct the histogram for the frequency of the variable SMOKER.



4. Construct a histogram containing the complex properties male smoker, male nonsmoker, female smoker, and female nonsmoker.



5. Without being told anything about the nature of the population, what do you know is wrong with the following histogram?



- (a) The height of the bar representing male smokers is too high.  
 (b) The height of the bar representing male nonsmokers is too high.  
 (c) The sum of the bar heights is too low.  
 (d) The sum of the bar heights is too high.

Refer to the following table to answer the questions 6 through 9.

Individual	SEX	HAIR COLOR	SMOKER
1	Male	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

6. What is the frequency of females (that is,  $\text{Fr}(\text{SEX} = \text{Female})$ )?

**Answer:** The relative frequency of females is  $\frac{4}{8} = \frac{1}{2}$

7. What is the frequency of non-smokers (that is,  $\text{Fr}(\text{SMOKER} = \text{No})$ )?

**Answer:** The relative frequency of non-smokers is  $\frac{5}{8}$

8. What is the frequency of blond females (that is,  $\text{Fr}(\text{HAIR COLOR} = \text{Blond} \ \& \ \text{SEX} = \text{Female})$ )?

**Answer:** The relative frequency of blond females is  $\frac{2}{8} = \frac{1}{4}$

9. What is the frequency of blond male smokers?

**Answer:** The relative frequency of blond females is  $\frac{2}{8} = \frac{1}{4}$

For questions 10 through 12, refer to the following contingency table:

	Male	Female
Smokers	50	60
Non-smokers	140	150

10. What is the total number of smokers in the group?

**Answer:** The total number of smokers is 110.

11. What is the total number of nonsmokers in the group?

**Answer:** The total number of nonsmokers is 290.

12. What is the total number in the group?

**Answer:** The total number of individuals in the group is 400.

13. According to the following contingency table, what is  $\text{Fr}(\text{SMOKER} = \text{Yes})$ ? What is  $\text{Fr}(\text{SEX} = \text{Male})$ ?

	Male	Female	Total
Smokers	230	170	400
Non-smokers	132	148	280
Total	362	318	680

**Answer:** The relative frequency of smokers is  $\frac{400}{680} \approx .588$ . The relative frequency of males is  $\frac{362}{680} \approx .532$

In the 1950s, infantile polio threatened every family with children. Jonas Salk, at the University of Pittsburgh, developed a vaccine which immunized animals against the disease. Salk’s initial tests on humans revealed no ill side effects and seemed to increase the immune response, even in those who had previously had polio. In 1954 the Public Health Service of the United States organized two experiments to test the new polio vaccine. In total, more than 400,000 children were innoculated with the vaccine, and more than a million others — the controls — were either given a salt water injection (called a placebo), or no inoculation at all.

In the first study, called the Observed Control Study (OCS), dozens of schools were selected, all 2nd graders within a selected school were offered inoculations, and all 1st and 3rd graders were used as ”observational controls.” In the Observed Control Study table below, the first row records the total number of 2nd graders vaccinated (V) as well as the total number who contracted Polio. The second row records the total number of 2nd graders not vaccinated ( $\sim V$ ) and how many of them contracted Polio. The third row records the 1st and 3rd graders who were not vaccinated ( $\sim V$ ).

Refer to the following table to answer questions 14 through 16:

Group	# of Children	# with polio
Grade 2 (V)	221,998	56
Grade 2 ( $\sim V$ )	123,605	55
Grade 1 & 3 ( $\sim V$ )	725,173	391
Total ( $\sim V$ )	848,778	446
Total	1,070,776	502

14. What is the relative frequency of polio among 2nd graders who did not receive the vaccination?

**Answer:**  $\frac{123,605}{1,070,776} \approx 0.115$

15. What is the relative frequency of polio among 1st and 3rd graders who did not have the vaccination?

**Answer:**  $\frac{725,173}{1,070,776} \approx 0.677$

16. What is the relative frequency of polio among 2nd graders who had the vaccination?

**Answer:**  $\frac{221,998}{1,070,776} \approx 0.207$

17. Properties are the same as

- (a) Variables
- (b) Variables applied to individuals
- (c) The value of a variable
- (d) None of the above

18. In a histogram, the relative frequency of a property is represented by:

- (a) The height of the bar corresponding to that frequency
- (b) The ratio of the bar height corresponding to that frequency to the total of all bar heights.
- (c) None of the above

19. The relative height of two bars in a histogram is:

- (a) The ratio of the relative frequencies of the properties corresponding to those bars.
- (b) The difference between the relative frequencies of the properties corresponding to those bars.
- (c) None of the above