

# Classroom Voting Questions: Statistics

## General Probability Rules & Conditional Probability

1. In a certain semester, 500 students enrolled in both Calculus I and Physics I. Of these students, 82 got an A in calculus, 73 got an A in physics, and 42 got an A in both courses. Which of the following probabilities is the smallest? The probability that a randomly chosen student
  - (a) got an A in at least one of the two courses.
  - (b) got less than an A in at least one of the two courses.
  - (c) got an A in both of the two courses.
  - (d) got an A in calculus but not in physics.
  - (e) got an A in physics but not calculus.
2. Three cards are placed in a hat—one card is blue on both sides, one card is red on both sides, and one card has one side blue and one side red. A card is drawn at random from the hat and you see that one side is blue. What is the probability that the other side is also blue?
  - (a)  $1/3$
  - (b)  $1/2$
  - (c)  $2/3$
3. Consider tossing a fair coin, that is, one that comes up heads half of the time and tails half of the time. Let  $A$  be the event “the first toss is a head,”  $B$  be the event “the second toss is a tails,”  $C$  be the event “the two outcomes are the same,”  $D$  be the event “two heads turn up.” Which of the following pairs of events is not independent?
  - (a)  $A$  and  $B$
  - (b)  $A$  and  $C$
  - (c)  $A$  and  $D$
4. Suppose  $A$  is the event that it rains today and  $B$  is the event that I brought my umbrella into work today. What is wrong with the following argument? “These events are independent because bringing an umbrella to work doesn’t affect whether or not it rains today.”

- (a) These events are not independent, because one's decision of bringing an umbrella is dependent on the likelihood of rain. (However, rain is definitely not dependent on one carrying an umbrella although Murphy's Law might prove the opposite.)
- (b) Although bringing an umbrella to work doesn't cause it to rain, given that you've brought your umbrella to work, the probability that it's a rainy day is higher than the chance of rain on any random day.
- (c) These events are independent because the probability of bringing an umbrella to work doesn't affect the probability of the event its rains today and vice versa.
- (d) It is false because the fact that it is raining today means that it was probably predicted to rain. If you checked that prediction then you would be more likely to bring in an umbrella making the events linked.

5. Assume that two events A and B are independent events. Which of the following statements is *false*?

- (a)  $P(A \text{ and } B) = P(A) * P(B)$
- (b)  $P(B|A) = [P(A|B) * P(B)]/P(A|B)$
- (c) A and B are mutually exclusive events.
- (d)  $P(A|B) * P(B|A) = P(A \text{ and } B)$

6. Through accounting procedures, it is known that about 10% of the employees in a store are stealing. The managers would like to fire the thieves, but their only tool in distinguishing them from the honest employees is a lie detector test that is only 90% accurate. That is, if an employee is a thief, he or she will fail the test with probability 0.9, and if an employee is not a thief, he or she will pass the test with probability 0.9. If an employee fails the test, what is the probability that he or she is a thief?

- (a) 90%
- (b) 75%
- (c) 66 2/3%
- (d) 50%

7. A recent article in the Oklahoma Daily suggested that marijuana is a gateway drug for harder drug use. Suppose we have the following "facts". When asked, 90% of current "hard drug" users admit previously using marijuana; 40% of the general population admit using marijuana at some point during their lives; and 20% of the general population admit to using "hard drugs" at some point in their life. Given these three facts, what is the conditional probability of "hard drug" use given prior marijuana usage?

- (a) 0.16

- (b) 0.20
- (c) 0.25
- (d) 0.45
- (e) 0.90

8. A recent article in the Oklahoma Daily suggested that marijuana is a gateway drug for harder drug use. The following fact which we will take as accurate - was used to support their argument: 9 out of 10 of "hard drug" users have previously used marijuana. Additionally, the newspaper also reported that 4 out of every 10 persons in the general population have admitted using marijuana and that 2 out of 10 persons in the general population have admitted partaking of "harder" drugs.

You now find out that one of your children has used marijuana. What is the probability of your child subsequently using some "hard drug" based on the information presented above?

- (a) 0.16
- (b) 0.20
- (c) 0.25
- (d) 0.45
- (e) 0.90

9. A cab was involved in a hit and run accident at night. Only two cab companies, the Transporter and the Rock, operate in the city. You are given the following data:

- (a) 85% of the cabs in the city are Transporters and 15% are Rocks.
- (b) A witness identified the cab as a Rock. The court tested the reliability of the witness under the same circumstances that existed on the night of the accident and concluded that the witness correctly identified each one of the two cabs 80% of the time and failed 20% of the time.

What is the probability that the cab involved in the accident was indeed a Rock?

- (a) 0.75
- (b) 0.41
- (c) 0.27
- (d) 0.63
- (e) 0.80

10. The following contingency table/two-way table classifies the members of a certain government into political party (Liberal or Conservative) and whether they support or oppose the spending bill that is currently up for adoption.

|              | Support | Oppose | Total |
|--------------|---------|--------|-------|
| Liberal      | 47      | 11     | 58    |
| Conservative | 14      | 35     | 49    |
| Total        | 61      | 46     | 107   |

Imagine randomly selecting one member of the government. Let  $L$ ,  $C$ ,  $S$ , and  $O$  denote the events of selecting a liberal, a conservative, a bill supporter, and a bill opposer, respectively. Find  $P(C \& S)$ .

- (a)  $\frac{14}{61}$
- (b)  $\frac{14}{49}$
- (c)  $\frac{14}{107}$
- (d) None of the above

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Imagine randomly selecting one member of the government. Let  $L$ ,  $C$ ,  $S$ , and  $O$  denote the events of selecting a liberal, a conservative, a bill supporter, and a bill opposer, respectively. Find  $P(S|L)$ .

- (a)  $\frac{47}{61}$
- (b)  $\frac{47}{58}$
- (c)  $\frac{47}{107}$
- (d) None of the above

12. A sample of sports fans from Canada and the United States were asked whether they would prefer to attend a professional basketball game or a professional (ice) hockey game. The following table gives a joint probability distribution for the sample.

|                      | <b>Basketball</b> | <b>Hockey</b> |
|----------------------|-------------------|---------------|
| <b>Canada</b>        | 0.026             | 0.312         |
| <b>United States</b> | 0.512             | 0.150         |

Imagine randomly selecting one member of this sample. Let  $C$ ,  $S$ ,  $B$ , and  $H$  denote the events of selecting someone from Canada, someone from the United States, someone who chose basketball, and someone who chose hockey, respectively. Find  $P(C|H)$ .

- (a) 0.312
  - (b) 0.675
  - (c) 0.923
  - (d) None of the above
13. A woman is the victim of a homicide, and her husband is on trial for her murder. It is known that prior to her murder, her husband had verbally threatened to kill her. During the trial, the defense attorney tells the court, "Only 1% of all men who threaten to kill their wives actually go on to kill them." There are, of course, many other pieces of evidence presented in the trial, but let's focus on this statement made by the defense attorney. TRUE or FALSE: The attorney's statement is a significant piece of evidence in favor of the man's innocence.
- (a) True, and I am very confident.
  - (b) True, and I am not very confident.
  - (c) False, and I am not very confident.
  - (d) False, and I am very confident.