Topic: Probability Fundamentals

1. According to a report for veterinarians in the United States, 36.5 percent of households in the United States own dogs and 30.4 percent of households in the United States own cats. If one household in the United States is selected at random, what is the probability that the selected household will own a dog or a cat?

   A. 0.111
   B. 0.331
   C. 0.558
   D. 0.669
   E. Not enough information is given to determine the probability.

2. In a certain school, 17 percent of the students are enrolled in a psychology course, 28 percent are enrolled in a foreign language course, and 32 percent are enrolled in either a psychology course or a foreign language course or both. What is the probability that a student chosen at random from this school will be enrolled in both a foreign language course and a psychology course?

   A. 0.45
   B. 0.32
   C. 0.20
   D. 0.13
   E. 0.05

3. A middle school chess club has 5 members: Adam, Bradley, Carol, Dave, and Ella. Two students from the club will be selected at random to participate in the county chess tournament. What is the probability that Adam and Ella will be selected?

   A. $\frac{1}{20}$
   B. $\frac{1}{10}$
   C. $\frac{1}{8}$
   D. $\frac{1}{7}$
   E. $\frac{1}{4}$

4. In a parking lot with 200 cars, 50 cars are white, 30 cars are red, and 20 cars are silver. One car will be selected at random from the parking lot. If each car in the parking has only one color, which of the following cannot be the probability that the selected car will be green?

A. 0

B. 0.1

C. 0.2

D. 0.5

E. 0.6

5. A large store has a customer service department where customers can go to ask for help with store-related issues. According to store records, approximately 1/4 of all customers who go to the service department ask for help finding an item. Assume the reason each customer goes to the service department is independent from customer to customer. Based on the approximation, what is the probability that at least 1 of the next 4 customers who go to the service department will ask for help finding an item?

A. $4\left(\frac{1}{4}\right)$

B. $1-\left(\frac{1}{4}\right)^4$

C. $1-\left(\frac{3}{4}\right)^4$

D. $4\left(\frac{1}{4}\right)^1\left(\frac{3}{4}\right)^3$

E. $\left(\frac{4}{4}\right)\left(\frac{3}{4}\right)\left(\frac{2}{4}\right)\left(\frac{1}{4}\right)$

$P(X \geq 1) = ?$

$X \sim \text{Binom}\left(4, \frac{1}{4}\right)$

$\binom{4}{0} = 1 \quad \left(\frac{1}{4}\right)^0 = 1$

$1 - P(X=0) = 1 - \binom{4}{0}\left(\frac{1}{4}\right)^0\left(1-\frac{1}{4}\right)^{4-0}$

6. At a sporting event, cheerleaders will throw 50 bundled T-shirts into the crowd. The T-shirt sizes consist of 10 small, 15 medium, and the remainder either large or extra large. Suppose Ana catches a T-shirt. What is the probability that she will catch a T-shirt that is not a size small?

A. 0.10

B. 0.20

C. 0.50

D. 0.67

E. 0.80

7. The following question(s) refer to the following scenario and set of data.

In the 1830s, land surveyors began to survey the land acquired in the Louisiana Purchase. Part of their task was to note the sizes of trees they encountered in their surveying. The table of data below is for bur oak trees measured during the survey.

Tree Diameter (in inches)	Frequency	Relative Frequency	Cumulative Frequency	Cumulative Relative Frequency
4	2	0.005	2	0.005
5	5	0.012	7	0.016
6	19	0.044	26	0.060
7	5	0.012	31	0.072
8	41	0.095	72	0.167
9	12	0.028	84	0.195
10	53	0.123	137	0.318
11	3	0.007	140	0.325
12	64	0.148	204	0.473
13	4	0.009	208	0.483
14	46	0.107	254	0.589
15	11	0.026	265	0.615
16	48	0.111	313	0.726
17	2	0.005	315	0.731
18	47	0.109	362	0.840
19				
20	30	0.070	392	0.910
21				
22	4	0.009	396	0.919
23				
24	18	0.042	414	0.961
25				
26	1	0.002	415	0.963
27				
28	2	0.005	417	0.968
29				
30	8	0.019	425	0.986
31				
32				
33				
34	1	0.002	426	0.988
35	1	0.002	427	0.991
36	3	0.007	430	0.998
37				
38	1	0.002	431	1.000

Which of the following differences in cumulative relative frequencies gives the proportion of trees that are 12 inches to 16 inches, inclusive, in diameter?

$P(12 \le X \le 16) = P(X \le 16) - P(X \le 11)$

A. $0.615 - 0.325$

B. $0.615 - 0.473$

C. $0.726 - 0.325$

D. $0.726 - 0.473$

E. $0.731 - 0.325$

8. Traffic data revealed that 35 percent of automobiles traveling along a portion of an interstate highway were exceeding the legal speed limit. Using highway cameras and license plate registrations, it was also determined that 52 percent of sports cars were also speeding along the same portion of the highway. What is the probability that a randomly selected car along the same portion of the highway was a speeding sports car?

   A. 0.870
   B. 0.673
   C. 0.182
   D. 0.170
   E. It cannot be determined from the information given.

9. A high school science teacher has 78 students. Of those students, 35 are in the band and 32 are on a sports team. There are 16 students who are not in the band or on a sports team. One student from the 78 students will be selected at random. Let event B represent the event of selecting a student in the band, and let event S represent the event of selecting a student on a sports team.

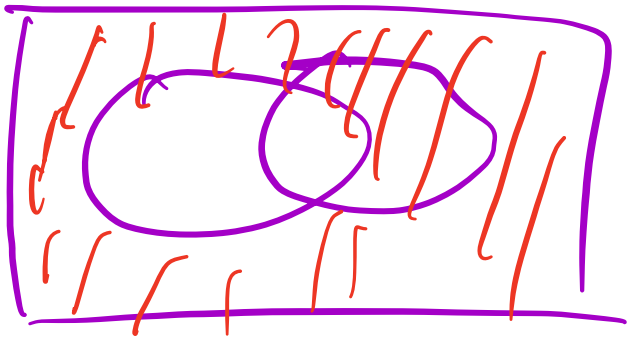
   Are B and S mutually exclusive events?

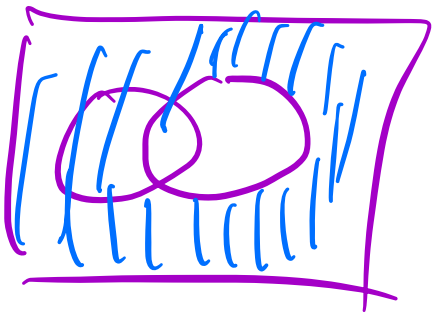
   A. No, because $P(B \cap S) = \frac{5}{78}$.
   B. No, because $P(B \cap S) = \frac{48}{78}$.
   C. No, because $P(B \cap S) = \frac{62}{78}$.
   D. Yes, because $P(B \cap S) = \frac{5}{78}$.
   E. Yes, because $P(B \cap S) = \frac{62}{78}$.

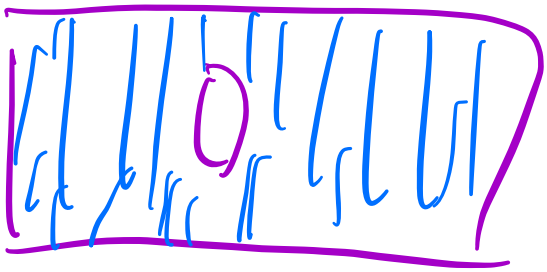
10. As a promotion, the first 50 customers who entered a certain store at a mall were asked to choose from one of two discounts. The first discount choice was 20% off all purchases made that day. The second discount choice was 10% off all purchases for the week. Of those who received the discounts, 28 chose the first discount and 22 chose the second discount. One customer will be selected at random from those who received a discount. Let F represent the event that the selected person chose the first discount, and let S represent the event that the selected person chose the second discount.

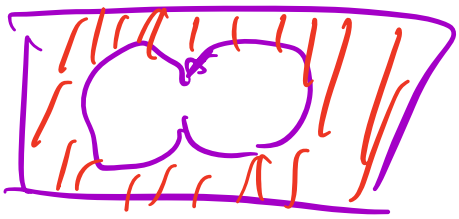
    Are F and S mutually exclusive events?

    A. Yes, because $P(F \cap S) = 0$.









$$P(B \cup S) = P(B) + P(S) - P(B \cap S)$$

$$1 - P(B^c \cap S^c)$$

$$1 - \frac{16}{78}$$

$P(B)$: $\frac{35}{78}$

$P(S)$: $\frac{32}{78}$

B. Yes, because $P(F \cap S) = 0.12$.

C. Yes, because $P(F \cap S) = 1$.

D. No, because $P(F \cap S) = 0$.

E. No, because $P(F \cap S) = 1$.

11.

	Team		
	Home	Away	Total
Purchased food	120	40	160
Did not purchase food	60	30	90
Total	180	70	250

The table shows data that were collected from people who attended a certain high school basketball game and indicates the team each person rooted for and whether each of these people purchased food during the game. A person who attended the game will be selected at random. Which of the following correctly interprets mutually exclusive events represented by the table?

A. Rooting for the home team and rooting for the away team

B. Rooting for the home team and purchasing food during the game

C. Rooting for the away team and purchasing food during the game

D. Rooting for the home team and not purchasing food during the game

E. Not rooting for the home team and not purchasing food during the game

12. A fair die with its faces numbered from 1 to 6 will be rolled. Which of the following is the best interpretation of the probability that the number landing face up will be less than 3 ?

long-run relative freq of event after many many trials

A. For many rolls of the die, the long-run relative frequency of a number less than 3 landing face up is $\frac{1}{3}$.

B. For many rolls of the die, the long-run relative frequency of a number less than 3 landing face up is $\frac{1}{2}$.

C. For many rolls of the die, the long-run relative frequency of a number less than 3 landing face up is $\frac{2}{3}$.

D. For three rolls of the die, a number less than 3 will land face up one time.

E. It will take three rolls of the die before a number less than 3 lands face up for the first time.

13. A store owner reports that the probability that a customer who purchases a lawn mower will also purchase an extended warranty is 0.68.

Which of the following is the best interpretation of the probability 0.68 ?

A. For all customers who purchase a lawn mower, 68% will also purchase an extended warranty.

B. For all customers of the store, 68% will purchase a lawn mower.

C. For all customers who purchase an extended warranty, 68% will use the warranty.

D. From the next 25 customers, 17 will purchase an extended warranty.

E. From the next 25 customers, 17 will purchase a lawn mower.

14. The probability that a randomly selected visitor to a certain website will be asked to participate in an online survey is 0.40. Avery claims that for the next 5 visitors to the site, 2 will be asked to participate in the survey.

Is Avery interpreting the probability correctly?

A. Yes, because 2 out of 5 is equal to 40%.

B. Yes, because participants in the survey are selected at random.

C. No, because there could be voluntary response bias.

D. No, because only 40% of all people will visit the site.

E. No, because 0.40 represents probability in the long run over many visits to the site.

Topic: Conditional Probability

15. Ninety percent of the people who have a particular disease will have a positive result on a given diagnostic test. Ninety percent of the people who do not have the disease will have a negative result on this test. If 5 percent of a certain population has the disease, what percent of that population would test positive for the disease?

P(A..) = ?

B ← has disease

A ← test positive.

P(B) = 0.05

P(A|B) = 0.9

P(A^c|B^c) = 0.9

A. 4.5%

B. 5%

C. 10%

D. 14%

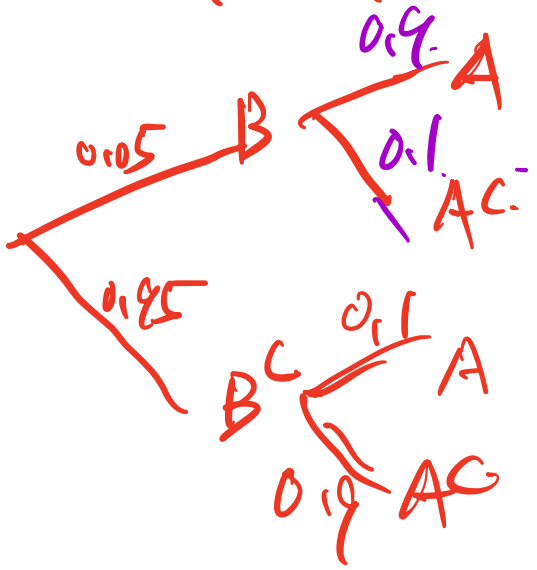
E. 90%

16. All bags entering a research facility are screened. Ninety-seven percent of the bags that contain forbidden material trigger an alarm. Fifteen percent of the bags that do not contain forbidden material also trigger the alarm. If 1 out of every 1,000 bags entering the building contains forbidden material, what is the probability that a bag that triggers the alarm will actually contain forbidden material?

$$P(A) = P(A \cap B) + P(A \cap B^c)$$

$$= P(B) \cdot P(A|B) + P(B^c) \cdot P(A|B^c)$$

$$= 0.05 \cdot 0.9 + (1-0.05) \cdot 0.1$$



A. 0.00097

B. 0.00640

C. 0.03000

D. 0.14550

E. 0.97000

17. A student is applying to two different agencies for scholarships. Based on the student's academic record, the probability that the student will be awarded a scholarship from Agency A is 0.55 and the probability that the student will be awarded a scholarship from Agency B is 0.40. Furthermore, if the student is awarded a scholarship from Agency A, the probability that the student will be awarded a scholarship from Agency B is 0.60. What is the probability that the student will be awarded at least one of the two scholarships?

A. 0.60

B. 0.62

C. 0.71

D. 0.73

E. 0.95

18. One student from a high school will be selected at random. Let A be the event that the selected student is a student athlete, and let B be the event that the selected student drives to school. If $P(A \cap B) = 0.08$ and $P(B \mid A) = 0.25$, what is the probability that the selected student will be a student athlete?

A. 0.02

B. 0.17

C. 0.32

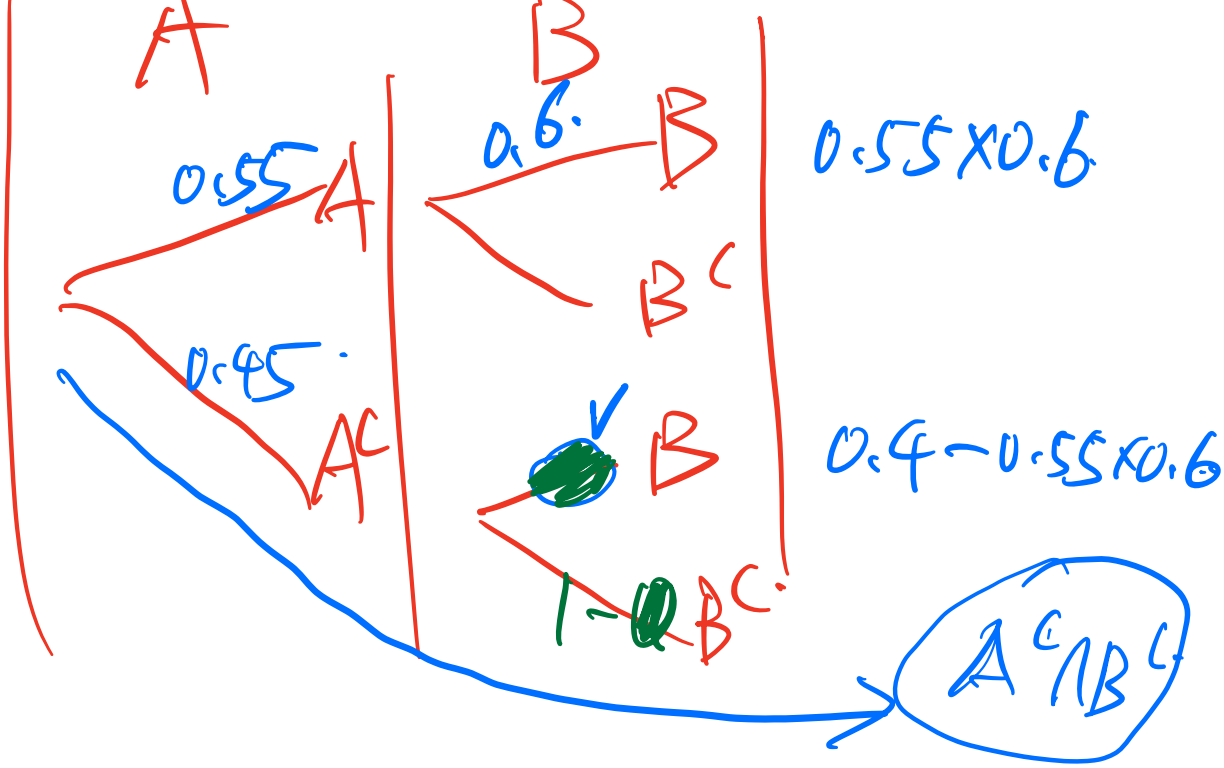
D. 0.33

E. 3.13

19. Each of the faces of a fair six-sided number cube is numbered with one of the numbers 1 through 6 , with a different number appearing on each face. Two such number cubes will be tossed, and the sum of the numbers appearing on the faces that land up will be recorded. What is the probability that the sum will be 4 , given that the sum is less than or equal to 6 ?

A. 2/36

B. 3/36


A
B
0.55
A
0.6
B
0.55×0.6
B^C
0.45
A^C
B
0.4−0.55×0.6
1−Q
B^C
A^C∩B^C

C. 3/15

D. 2/9

E. 4/6

20. For flights from a particular airport in January, there is a 30 percent chance of a flight being delayed because of icy weather. If a flight is delayed because of icy weather, there is a 10 percent chance the flight will also be delayed because of a mechanical problem. If a flight is not delayed because of icy weather, there is a 5 percent chance that it will be delayed because of a mechanical problem. If one flight is selected at random from the airport in January, what is the probability that the flight selected will have at least one of the two types of delays?

A. 0.065

B. 0.335

C. 0.350

D. 0.450

E. 0.665

21. The probability that a new microwave oven will stop working in less than 2 years is 0.05. The probability that a new microwave oven is damaged during delivery and stops working in less than 2 years is 0.04. The probability that a new microwave oven is damaged during delivery is 0.10. Given that a new microwave oven is damaged during delivery, what is the probability that it stops working in less than 2 years?

A. 0.05

B. 0.06

C. 0.10

D. 0.40

E. 0.50