

MTH 102 Module 4 In-Class Assignment

This week, all your work goes in this Word document. Your work must be submitted as a .docx or .pdf file!

You must show all your work to receive full credit!

Operation On Sets & Venn Diagram

- 1) Given the following sets: $S = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6\}$

- a) Find $A \cap B$.

$$\{2, 4\}$$

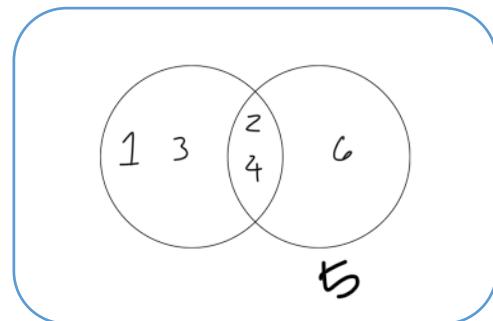
- b) Find $A \cup B$.

$$\{1, 2, 3, 4, 6\}$$

- c) Find A' .

$$\{5, 6\}$$

- d) Complete the Venn Diagram below (the left circle represents A, the right circle represents B).



Basic Probability

- 2) Experiment: Flipping a coin **two times**.

- a) What is the sample space of this experiment (the order of your flips matters here)?

$$4$$

- b) Using “curly-bracket notation”, write down the event A for “getting heads on the *second* coin flip”?

$$\{(t, h), (h, h)\}$$

- c) What is the probability of the event A from part (b)?

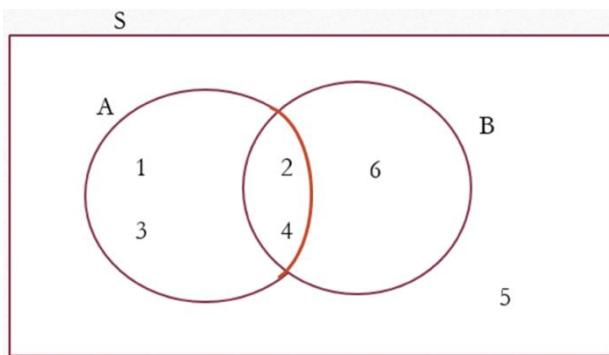
$$\frac{1}{4}$$

- 3) A baker finds several new recipes to try. Of the new recipes, there are 11 for cookies, 10 for muffins, and 4 for cakes. If the baker selects a recipe at random, what is the probability that the recipe is for a cake? *Write your answer as a fraction in reduced terms.*

$$\frac{4}{25}$$

Intermediate probabilities with Venn diagrams

- 4) Given the following sets: $S = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6\}$



- a) Find $P(A \cap B)$. *Write your answer as a fraction in reduced terms.*

$$\frac{2}{8} \quad \frac{1}{3}$$

- b) Find $P(A \cup B)$. *Write your answer as a fraction in reduced terms.*

$$\frac{5}{6}$$

- c) Find $P(A')$.

$$\frac{1}{6}$$

- 5) On a statistics exam, 8 students received an A, 4 students received a B, and 6 students received a C. If a single student is picked at random, what is the probability that they did **not** receive an A? *Write your answer as a fraction in reduced terms.*

$$\frac{10}{18} \quad \frac{5}{9}$$

- 6) On a statistics exam, 8 students received an A, 4 students received a B, and 6 students received a C. if a single student is picked at random, what is the probability that they received an A **or** C?
Write your answer as a fraction in reduced terms.

$$\frac{8}{18} + \frac{6}{18} = \frac{14}{18} \boxed{\frac{7}{9}}$$

Addition rule for probabilities

Recall the Addition Rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

- 7) In a certain group of 53 students, 17 are taking accounting, 21 are taking chemistry, and 4 are taking both. What is the probability that a randomly chosen student is taking accounting **or** chemistry? *Write your answer as a fraction in reduced terms.*

$$P(A) = \frac{17}{53} \quad \left\{ \begin{array}{l} P(A \cap C) = 4 \\ P(C) = \frac{21}{53} \end{array} \right. \quad \left\{ \begin{array}{l} \frac{17}{53} + \frac{21}{53} - \frac{4}{53} = \frac{34}{53} \end{array} \right. \boxed{\frac{34}{53}}$$

- 8) If a card is picked at random from a standard 52-card deck, what is the probability of drawing a face card **or** a heart? *Write your answer as a fraction in reduced terms.*

$$P(F) = \frac{12}{52} \quad \left\{ \begin{array}{l} P(F \cap H) = \frac{3}{52} \\ P(H) = \frac{13}{52} \end{array} \right. \quad \left\{ \begin{array}{l} \frac{12}{52} + \frac{13}{52} - \frac{3}{52} = \frac{22}{52} = \frac{11}{26} \end{array} \right. \boxed{\frac{11}{26}}$$

Independent, Dependent & Mutually Exclusive Events

- 9) If we roll two dice, determine whether each of the following pairs of events are independent or dependent.
- Event A is rolling a 1 on the first die. Event B is rolling a 2 on the second die.

Independent

- Event A is rolling a 6 on the first die. Event B is getting a sum of more than 7 with the two dice.

dependent

Using the Multiplication Rule for Independent Events

Recall that, if A and B are independent events, then

$$P(A \cap B) = P(A) \cdot P(B)$$

- 10) If A and B are independent events with $P(A) = 0.74$ and $P(B) = 0.32$, find $P(A \cap B)$.

$$0.74 \times 0.32 = \boxed{0.2368}$$

- 11) Bill and Sam are playing a game where they roll a die and draw a card from a deck. What is the probability of rolling a 5 and then drawing a 5 from the deck of cards? Write your answer as a fraction in reduced terms.

$$\frac{1}{6} \times \frac{4}{52} = \frac{4}{312} = \boxed{\frac{1}{78}}$$

Use the Multiplication Rule for Conditional Probabilities

If events A and B are not independent, then $P(A \text{ and } B) = P(A) * P(B|A)$.

- 12) Let A and B be two events such that $P(B) = 0.35$ and $P(A|B) = 0.38$. Calculate $P(A \cap B)$. Round your answer to two decimal places, if needed.

$$\begin{aligned} P(A \cap B) &= P(B) * P(A|B) \\ &\approx 0.35 * 0.38 = .1313 \end{aligned}$$

- 13) Given that the probability of a family owning a dog is 0.88, and the probability of a family owning a cat given that the family owns a dog is 0.34, what is the probability of a family owning a cat and a dog? Round your answer to two decimal places if needed.

$$P(D) = 0.88$$

$$P(C|D) = 0.34$$

$$P(C \cap D) = 0.88 * 0.34 = \boxed{0.30}$$

- 14) Given that the probability of a student taking a physics class is 0.74, and the probability of a student taking a math class given that the student takes a physics class is 0.24, what is the probability of a student taking a math class and a physics class? Round your answer to two decimal places if needed.

$$P(\text{phy}) = 0.74$$

$$P(\text{math}|\text{phy}) = 0.24$$

$$P(\text{math} \cap \text{phy}) = 0.74 \times 0.24 = \boxed{0.18}$$

Independent and Mutually Exclusive Events

Conditional Probability and Independent Events

The events A and B are independent if one the following equations hold:

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

$$P(A|B) = P(A)$$

$$P(B|A) = P(B)$$

Conditional Probability and Mutually Exclusive Events

The events A and B are mutually exclusive if one of the following equations hold:

$$P(A \text{ and } B) = 0$$

$$P(A|B) = 0$$

$$P(B|A) = 0$$

- 15) Given the following information about events A, B and C, determine which pairs of events, if any, are independent, which pairs, if any are mutually exclusive. Note there are three pairs to consider here: A and B, B and C, A and C. For each pair you should state if they are independent, and you should also state if they are mutually exclusive!

$P(A) = 0.58$	$P(A B) = 0$
$P(B) = 0.32$	$P(C B) = 0.63$
$P(C) = 0.63$	$P(A C) = 0.58$

		independent?	mutually exclusive?
	N		y
y			N
y			N