

Name_____

Date_____

Advanced Algebra

Unit 7: Probability Laws Assignment #17

Using the Laws of Probability and Conditional Probability

- 1) The probability of A or B can be given by the following rule:

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

- 2) Mutually Exclusive Events: 2 events that cannot occur at the same time. This can be demonstrated by the following rule:

$$P(A \cap B) = 0 \text{ so from our rule above we can say that if 2 events are mutually exclusive we have } P(A \cup B) = P(A) + P(B)$$

- 3) Conditional Probabilities:

$A|B$ is used to represent that "A occurs knowing that B has occurred"
 $A|B$ is read as "A given B"

If A and B are events then $P(A|B) = \frac{P(A \cap B)}{P(B)}$ From this equation it follows that
 $P(A \cap B) = P(A|B) * P(B)$ or $P(A \cap B) = P(B|A) * P(A)$

- 4) Independent Events- A and B are independent events if the occurrence of each one of them does not affect the probability that the other occurs. This can be shown with the following

A and B are independent events if $P(A \cap B) = P(A) * P(B)$

Assignment #17

Practice Problems:

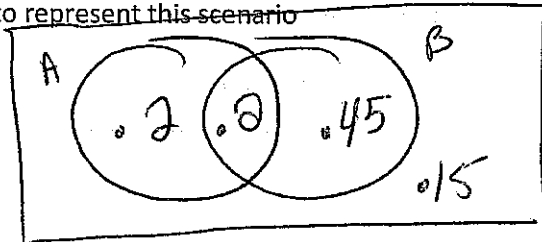
1) Events A and B have probabilities $P(A) = .4$, $P(B) = .65$ and $P(A \cup B) = .85$

$$.85 = .4 + .65 - x$$

$$x = .2$$

a) Draw the Venn Diagram to represent this scenario

(2 marks)



b) Calculate $P(A \cap B)$

(2 marks)

$$.2$$

c) State with support if A and B are Independent

(2 marks)

$$.4 \times .65 \stackrel{?}{=} .2 \quad .26 \neq .2 \quad \text{NO}$$

d) State with a reason if A and B are mutually exclusive

(2 marks)

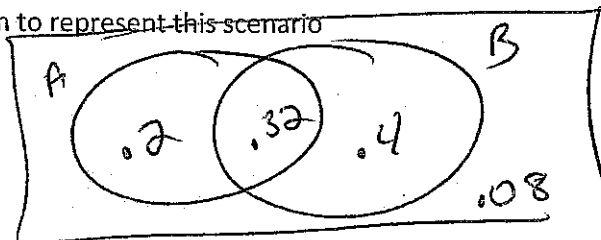
NO

2) Events A and B have probabilities $P(A) = .52$, $P(B) = .72$ and $P(A \cup B) = .92$

$$.92 = .52 + .72 - x$$

a) Draw the Venn Diagram to represent this scenario

(2 marks)



b) Calculate $P(A \cap B)$

(2 marks)

$$.32$$

c) State with support if A and B are Independent

(2 marks)

$$.52 \times .72 = .3744 \neq .32$$

d) State with a reason if A and B are mutually exclusive

(2 marks)

NO

Assignment # 17

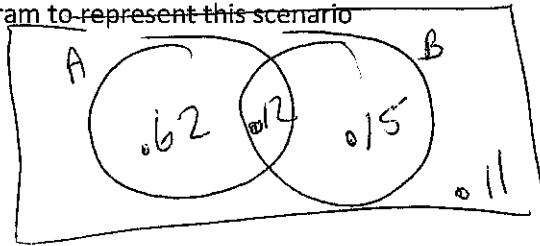
Practice Problems:

1) Events A and B have probabilities $P(A) = .74$, $P(B) = .27$ and $P(A \cup B) = .89$

$$.89 = .74 + .27 - x$$

a) Draw the Venn Diagram to represent this scenario

(2 marks)



b) Calculate $P(A \cap B)$

(2marks)

$$.12$$

c) State with support if A and B are Independent

(2marks)

$$.74 \times .27 = .1998 \neq .12 \text{ NO}$$

d) State with a reason if A and B are mutually exclusive

(2marks)

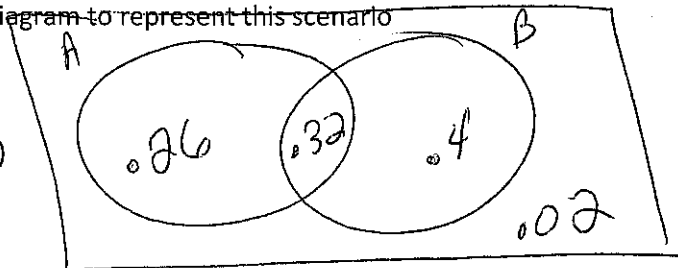
NO

2) Events A and B have probabilities $P(A) = .58$, $P(B) = .72$ and $P(A \cup B) = .98$

$$.98 = .58 + .72 - x$$

a) Draw the Venn Diagram to represent this scenario

(2 marks)



b) Calculate $P(A \cap B)$

(2marks)

$$.32$$

c) State with support if A and B are Independent

(2marks)

d) State with a reason if A and B are mutually exclusive

(2marks)

NO

Assignment #7

3) If $P(A) = .6$ $P(A \cup B) = .95$ and $P(A \cap B) = .32$, Find $P(B)$

Answer to $P(B)$ here:
 $P(B) = .67$

$$.95 = .6 + P(B) - .32$$

4) $P(X) = .85$ $P(Y) = .40$ and $P(X \cup Y) = .99$ find $P(X \cap Y)$

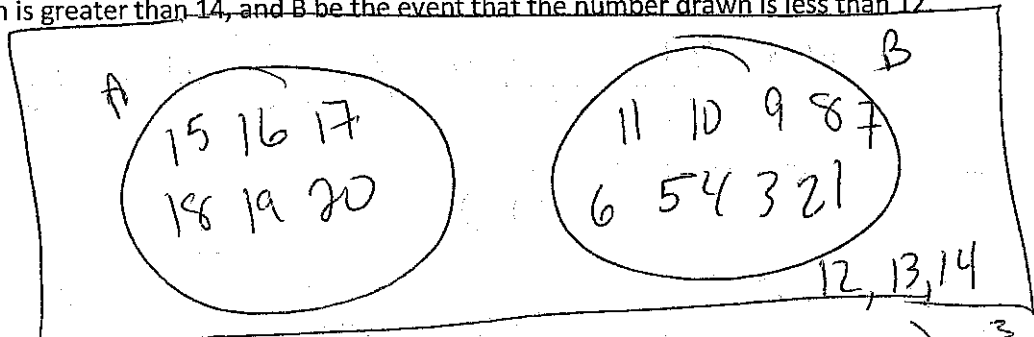
Answer to $P(X \cap Y)$ here
 $P(X \cap Y) = .26$

$$.99 = .85 + .4 - X$$

$$X = .26$$

5) Tickets numbered 1 to 20 are placed in a hat, and one ticket is chosen at random. Let A be the event that the number drawn is greater than 14, and B be the event that the number drawn is less than 12

Draw a Venn Diagram



Find $P(A)$ $P(B)$ $P(A \cup B)$ Are A and B Mutually exclusive?

yes

$$P(A) = \frac{6}{20}$$

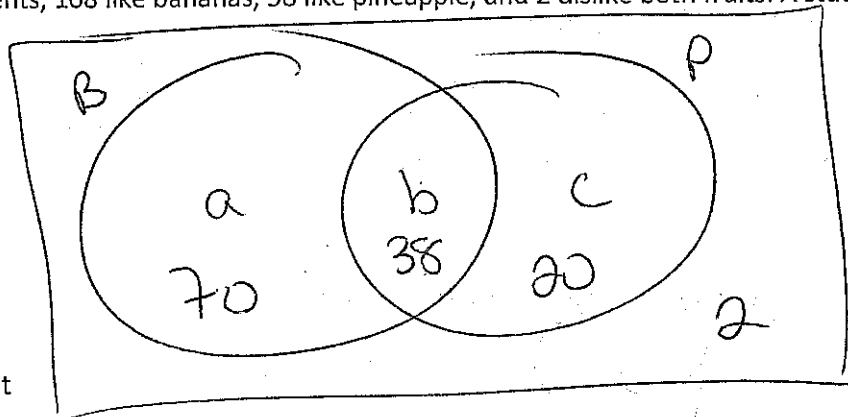
$$P(B) = \frac{11}{20}$$

$$P(\text{neither}) = \frac{3}{20}$$

$$P(A \cup B) = \frac{17}{20}$$

6) In a class of 130 students, 108 like bananas, 58 like pineapple, and 2 dislike both fruits. A student is randomly selected.

Draw the Venn Diagram



$$a + b = 108$$

$$b + c = 58$$

$$a + b + c = 128$$

$$108 + c = 128$$

$$c = 20$$

Find the probability that

a) dislikes pineapple given that he or she likes bananas

$$\frac{70}{108} = .648$$

the student likes both fruits $P(B \cap P)$
 $\frac{38}{130} = .29$

Likes at least one fruit
 $\frac{128}{130} = .98$

Likes bananas given than he or she likes pineapple $P(B|P)$
 $\frac{38}{58} = .66$