Advanced Algebra

Unit 8: 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:

$P(A \cap B) = 0$ 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 $P(A \cap B) = P(A)*P(B)$

Practice Problems:

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

a) Draw the Venn Diagram to represent this scenario   (2 marks)

b) Calculate P (A∩B)   (2marks)

c)State with support if A and B are Independent   (2marks)

d) State with a reason if A and B are mutually exclusive   (2marks)

_____

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

a) Draw the Venn Diagram to represent this scenario   (2 marks)

b) Calculate P (A∩B)   (2marks)

c)State with support if A and B are Independent   (2marks)

d) State with a reason if A and B are mutually exclusive   (2marks)

Practice Problems:

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

a) Draw the Venn Diagram to represent this scenario   (2 marks)

b) Calculate P (A∩B)   (2marks)

c)State with support if A and B are Independent   (2marks)

d) State with a reason if A and B are mutually exclusive   (2marks)

_____

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

a) Draw the Venn Diagram to represent this scenario   (2 marks)

b) Calculate P (A∩B)   (2marks)

c)State with support if A and B are Independent   (2marks)

d) State with a reason if A and B are mutually exclusive   (2marks)

3) If P(A) = .6   P(A∪B) = .95 and P(A∩B) = .32, Find P(B)

Answer to P(B) here:

4) P(X) = .85   P(Y) =.40 and P(X∪Y) =.99   find P(X∩ Y)

Answer to P(X∩ Y) *here*

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∪B)   Are A and B Mutually exclusive?

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

Find the probability that

    a)   dislikes pineapple given that he or she likes bananas

the student likes both fruits P($B \cap P$)

Likes at least one fruit

Likes bananas given than he or she likes pineapple P(B|P)