Assignment 61-4

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A

Let A and B be 2 such events such that

$$P(A) = 0.4, P(B) = 0.7, P(A \cup B) = 0.9$$

(a) Find $P(A \cap B)$

$$P(A) + P(B) - P(A \cap B) = P(A \cup B)$$
$$P(A \cap B) = P(A) + P(B) - P(A \cup B)$$
$$P(A \cap B) = 0.4 + 0.7 - 0.9 = 1.1 = 4 - 0.9 = 0.2$$

(b) Find $P(A^c \cap B)$
Same as what is not in A and in B

$$P(A^c \cap B) = P(B) - P(A \cap B) = 0.7 - 0.2 = 0.5$$

(c) Find $P(A - B)$

$$P(A - B) = P(A) - P(A \cap B) = 0.4 - 0.2 = 0.2$$

(d) Find $P(A^c - B)$

$$P(A^c - B) = P(A^c) - P(A^c \cap B) = (1 - P(A)) - 0.5 = 1 - 0.4 - 0.5 = 0.1$$

(e) Find $P(A^c \cup B)$

$$P(A^c \cup B) = (1 - P(A)) + P(A \cap B) = (1 - 0.4) + 0.2 = 0.8$$

If you think about this as a venn diagram it is everything not in a combined with everything in B. Everything not in A is 1-P(A) and if you look at the diagram this includes part of B. The part not included is $A \cap B$. So we combine

1-A and $A \cap B$ to get $P(A^c \cup B)$
(f) Find $P(A \cap (B \cup A^c))$

$$P(A \cap (B \cup A^c)) = P(A \cap B) = 0.2$$

The reason $A \cap (B \cup A^c)$ is the same as $A \cap B$ is because if you think about $B \cup A^c$ the only part of that in A is $B \cap A$ so if we are finding the intersection of that and A it is only $A \cap B$

B

I roll a fair die twice and obtain 2 numbers: X_1 = the result of the first roll, X_2 = the result of the second roll.

(a) Find the probability that $X_2 = 4$

$$P(X_2 = 4) = \frac{\text{Times where } X_2 = 4}{\text{Possibilities for } X_2} = \frac{1}{6}$$

(b) Find the probability that $X_1 + X_2 = 7$

$$P(X_2 = 4) = \frac{\text{Times where } X_1 + X_2 = 7}{\text{Possibilities for } X_1 + X_2} = \frac{6}{11}$$

(c) Find the probability that $X_1 \neq 2$ and $X_2 \geq 4$

$$P(X_1 \neq 2) \cdot P(X_2 \geq 4) = \frac{5}{6} \cdot \frac{3}{6} = \frac{15}{36} = \frac{5}{12}$$