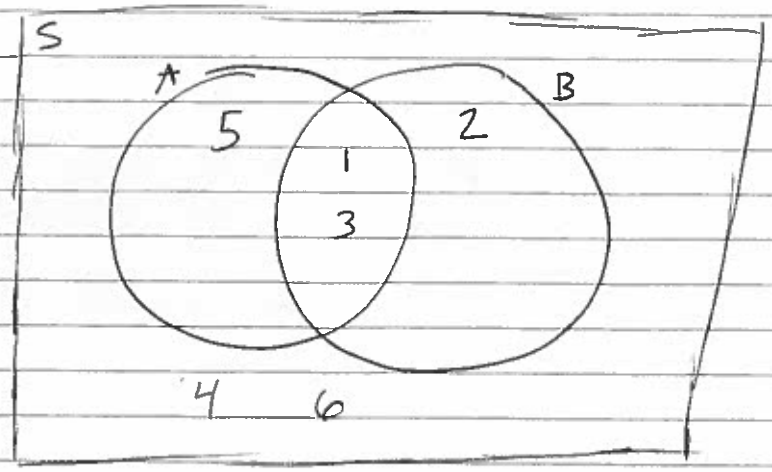
Lab 04 - Probability and Bayes' Theorem

Part 1

① 

② Addition Law - probability of an odd or a result less than or equal to 3.

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

$$= \frac{3}{6} + \frac{3}{6} - \frac{2}{6}$$

$$= \frac{6}{6} - \frac{3}{6}$$

$$P(A \cup B) = \frac{4}{6} \text{ or } \frac{2}{3}$$

The probability of rolling an odd result or a result less than or equal to 3 is $\frac{2}{3}$ or .6666.

③ Conditional Probability - probability of an odd roll given a result less than or equal to 3.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$= \frac{\frac{2}{6}}{\frac{3}{6}}$$

$$P(A|B) = \frac{2}{3}$$

The probability of an odd roll given that the roll is less than or equal to 3 is $\frac{2}{3}$ or .6666.

Lab 04 - Probability and Bayes' Theorem

(4) Multiplicative Law - what is the probability of rolling an odd number and a number less than or equal to 3?

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

[A] $P(A) = 3/6$ or $1/2$

[B] $P(B) = 3/6$ or $1/2$

[C]
$$P(B|A) = \frac{P(A \cap B)}{P(A)} =$$

$$= \frac{2/6}{1/2}$$

$$P(B|A) = 2/3$$

[D] $P(A \cap B) = P(A) * P(B|A)$

$$= 1/2 * 2/3$$

$$P(A \cap B) = 1/3$$

(5) Independence

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

$$1/3 = 1/2 * 1/2$$

$$1/3 \neq 1/4$$

This result indicates that, giving this combination of die outcomes, the likelihood of event A is dependent on event B.

Lab 04- Probability and Bayes' Theorem

Part 2

(6) $x = .2$

(7) $y = .65$

(8) $z = .12$

(9) Posterior Probability $= \frac{(.2)(.65)}{(.2)(.65) + (.12)(1-.2)}$

$= \frac{.13}{.13 + (.12)(.8)}$

$= \frac{.13}{.13 + .096}$

$= \frac{.13}{.226}$

Posterior Probability $= .575$

The estimate of the crime rate continuing to fall is 57.5% or .575.