

University of Maryland, College Park
Department of Civil & Environmental Engineering

Quiz 2, Closed book & notes, for 15 minutes
 October 5, 2001

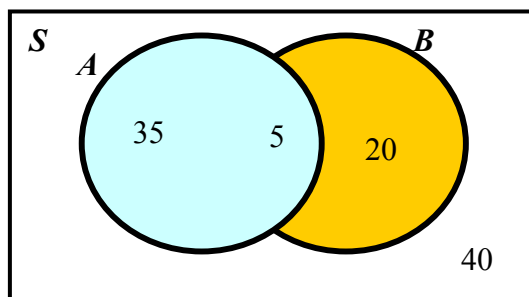
ENCE 302

Probability and Statistics for Civil Engineers

Name: _____

Problem 1

Refer to the Venn diagram shown below for event A and B in the sample space S . Find each of the indicated probabilities.



a. $P(A)$ and $P(\bar{A})$

$$P(A) = \frac{35 + 5}{35 + 5 + 20 + 40} = \frac{40}{100} = 0.4$$

$$P(\bar{A}) = 1 - 0.4 = 0.6$$

b. $P(B)$ and $P(\bar{B})$

$$P(B) = \frac{5 + 20}{35 + 5 + 20 + 40} = \frac{25}{100} = 0.25$$

$$P(\bar{B}) = 1 - 0.25 = 0.75$$

c. $P(A \cap B)$ and $P(\bar{A} \cap \bar{B})$

$$P(A \cap B) = \frac{5}{35 + 5 + 20 + 40} = \frac{5}{100} = 0.05$$

$$P(\bar{A} \cap \bar{B}) = \frac{40}{35 + 5 + 20 + 40} = \frac{40}{100} = 0.4$$

d. $P(\bar{A} \cap B)$ and $P(A \cap \bar{B})$

$$P(\bar{A} \cap B) = \frac{20}{100} = 0.20 \quad \text{and} \quad P(A \cap \bar{B}) = \frac{35}{100} = 0.35$$

e. $P(A \cup B)$ and $P(\overline{A \cup B})$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0.40 + 0.25 - 0.05 = 0.6$$

$$P(\overline{A \cup B}) = 1 - P(A \cup B) = 1 - 0.60 = 0.40, \text{ Also, } P(\overline{A \cup B}) = P(\bar{A} \cap \bar{B}) = 0.4$$

Problem 2

If the sample space $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ and $A = \{0, 2, 4, 6, 8\}$, $B = \{1, 3, 5, 7, 9\}$, $C = \{2, 3, 4, 5\}$, and $D = \{1, 6, 7\}$, list the elements of the sets corresponding to the following events:

a) $A \cup C$

$$A \cup C = \{0, 2, 3, 4, 5, 6, 8\}$$

b) $A \cap B$

$$A \cap B = \emptyset = \text{empty set or impossible event}$$

c) \bar{C}

$$\bar{C} = \{0, 1, 6, 7, 8, 9\}$$

d) $(\bar{C} \cap D) \cup B$

$$(\bar{C} \cap D) \cup B = \{1, 6, 7\} \cup B = \{1, 3, 5, 6, 7, 9\}$$

e) $\overline{S \cap C}$

$$\overline{S \cap C} = \bar{S} \cup \bar{C} = \emptyset \cup \bar{C} = \{0, 1, 6, 7, 8, 9\}$$

Formulas

Rule Type	Operations
Identity Laws	$A \cup \emptyset = A, A \cap \emptyset = \emptyset, A \cup S = S, A \cap S = A$
Idem potent Laws	$A \cup A = A, A \cap A = A$
Complement Laws	$A \cup \bar{A} = S, A \cap \bar{A} = \emptyset, \bar{\bar{A}} = A, \bar{S} = \emptyset, \bar{\emptyset} = S$
Commutative Laws	$A \cup B = B \cup A, A \cap B = B \cap A$
Associative Laws	$(A \cup B) \cup C = A \cup (B \cup C), (A \cap B) \cap C = A \cap (B \cap C)$
Distributive Laws	$(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$ $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$
De Morgan's Law	$\overline{(A \cup B)} = \bar{A} \cap \bar{B}, \overline{(E_1 \cup E_2 \dots \cup E_n)} = \bar{E}_1 \cap \bar{E}_2 \dots \cap \bar{E}_n$ $\overline{(A \cap B)} = \bar{A} \cup \bar{B}, \overline{(E_1 \cap E_2 \cap \dots \cap E_n)} = \bar{E}_1 \cup \bar{E}_2 \cup \dots \cup \bar{E}_n$
Combinations of Laws	$\overline{(A \cup (B \cap C))} = \bar{A} \cap (\bar{B} \cap \bar{C}) = (\bar{A} \cap \bar{B}) \cup (\bar{A} \cap \bar{C})$

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n x_i$$

$$COV = \frac{\text{standard deviation}}{\text{mean (or average)}} = \frac{S}{\bar{X}}$$

$$S^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{X})^2$$

$$S^2 = \frac{1}{n-1} \left[\sum_{i=1}^n x_i^2 - \frac{1}{n} \left(\sum_{i=1}^n x_i \right)^2 \right]$$

OR

$$S^2 = \frac{1}{n-1} \left[\sum_{i=1}^n x_i^2 - n\bar{X}^2 \right]$$