Formulas for Math 1320 Exam 3

Set Operations

1. Union : $A \cup B = \{x | x \in A \text{ or } x \in B\}$
2. Intersection : $A \cap B = \{x | x \in A \text{ and } x \in B\}$
3. Complement : $A' = \{x \in S | x \notin A\}$
4. Cartesian Product : $A \times B = \{(a, b) | a \in A \text{ and } b \in B\}$ where $A \times B$ is the set of all ordered pairs whose first component is in A and whose second component is in B.

Cardinality

If A is a finite set, then its cardinality is $n(A) =$ the number of elements in A.

1. Union : $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
2. Complement : $n(A') = n(S) - n(A)$
3. Cartesian Product : $n(A \times B) = n(A)n(B)$

Permutations

$$n! = n \times (n-1) \times (n-2) \times \cdots \times 2 \times 1 \qquad \text{and} \qquad 0! = 1.$$

Permutations of n items taken r at a time

A permutation of n items taken r at a time is an ordered list of r items chosen from a set of n items.

$$P(n, r) = \frac{n!}{(n-r)!} = n \times (n-1) \times (n-2) \times \cdots \times (n-r+1).$$

Combinations of n items taken r at a time

A Combinations of n items taken r at a time is an unordered set of r items chosen from a set of n items.

$$C(n, r) = \frac{P(n, r)}{r!} = \frac{n!}{r!\,(n-r)!}$$

Relative frequency or Estimated Probability

$$P(E) = \frac{fr(E)}{N} = \frac{\text{Frequency of event E}}{\text{Total number of experiments}}$$

Probability Model for Equally Likely Outcomes

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{n(E)}{n(S)}.$$

Probability of the Complement of an Event

$P(A') = 1 - P(A)$ (The probability of A *not* happening is 1 minus the probability of A)

Addition Principle: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

If $A \cap B = \emptyset$, we say that A and B are **mutually exclusive**, we have $P(A \cup B) = P(A) + P(B)$.

Conditional Probability: If A and B are events with $P(B) \neq 0$, then the probability of A given B is

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

Multiplication Principle for Conditional Probability: If A and B are events, then$P(A \cap B) = P(A \mid B)P(B)$.

Independent Events: The events are independent if $P(A \cap B)$ = $P(A)P(B)$