CRAFTON HILLS COLLEGE TUTORING CENTER

Chapter 3: Probability

Probability Requirements	Notation
• The probability of event E must be between 0 and 1, inclusive. • The sum of the probabilities of all outcomes in a sample must equal to 1 or 100%.	$0 \leq P(E) \leq 1$

Complimentary Events 3.1

$P(E') = 1 - P(E)$	$P(\text{At least one of "}A\text{"}) = 1 - P(\text{None of "}A\text{"})$

Multiplication Rule-AND 3.2

$P(A \text{ and } B) = P(A) \cdot P(B)$	*(A and B are independent)*
$P(A \text{ and } B) = P(A) \cdot P(B\|A)$	*(A and B are dependent)*

Additional Rule - OR 3.3

$P(A \text{ or } B) = P(A) + P(B)$	*(A and B are mutually exclusive)*
$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$	*(A and B are NOT mutually exclusive)*

Classical Approach	Empirical/Statistical	Conditional Probability	Independence Rule
$P(E) = \frac{\text{\# of outcomes in even } E}{\text{Total sample size}}$	$P(E) = \frac{\text{Frequency of Event } E}{\text{Total frequency}}$ $= \frac{\boldsymbol{f}}{\boldsymbol{n}}$	$P(A\|B) = \frac{P(A \text{ and } B)}{P(B)}$	$P(A\|B) = P(A)$ OR When $P(B\|A) = P(B)$

Counting Techniques 3.4

Permutation (*Order Matters*):	Combination (*Order Does Not Matter)*:
$_nP_r = \frac{n!}{(n-r)!}$ =**PERMUT**(n,r)	$_nC_r = \frac{n!}{(n-r)!\,r!}$ =**COMBIN**(n,r)

Distinct Items (*Multiplication Principle of Counting)*:	Permutation (*Distinguishable*):
__ × __ × __ × __ × … *Multiply all the possible outcomes*	$\frac{n!}{n_1!\,n_2!\,\ldots n_k!}$ *Where:* $\boldsymbol{n} = n_1 + n_2 + n_3 + \ldots + n_k$ Permutations of n objects where n_1 are one type, n_2 are another type and so on

NOTATION

$\boldsymbol{n}$ = Sample Size/Total # of Items	$_nP_r$ = Permutation	$P(x)$ = Probability of
$\boldsymbol{r}$ = # of objects chosen	$_nC_r$ = Combination	$P(A\|B)$ = Probability of A given B
$\boldsymbol{k}$ = 1, 2, 3… items	$!$ = Factorial	$P(B\|A)$ = Probability of B given A