Stat 230 - Probability **Fall 2016**

Lecture 4: September 16, 2016

Lecturer: Nagham Mohammad *Notes By: Harsh Mistry*

4.1 Probability-Counting Techniques

4.1.1 Events in Uniform Probability Model

In a a uniform model, where all the outcomes have the same chance of occurring the. The probability of event A is :

$$P(A) = \frac{\text{Number of outcomes in A}}{\text{Total Number of outcomes in S}}$$

4.1.2 The Basic Principal of Counting

- Addition Rule
  - If there are two tasks to be performed; Then if task 1 can be completed with p possible outcomes and there q possible outcomes for task 2. Then, either task 1 or task 2 (but not both), can be completed in p + q ways.
- Multiplication Rule
  - If there are two tasks to be performed; Then if task 1 can be completed with p possible outcomes and if, for each outcome of task 1, there are q possible outcomes of task 2, Then, together (AND) there are **pq** possible outcomes of two tasks..
  - $S = \begin{Bmatrix} (1,1) & (1,2) & \dots & (1,q) \\ (2,1) & (2,2) & \dots & (2,q) \\ \vdots & \vdots & \vdots & \vdots \\ (p,1) & (p,2) & \dots & (p,q) \end{Bmatrix}$

4.1.3 Generalized Principal of Counting

If r experiments that are to be performed are such that the first one may result in any of n_1 possible outcomes; and if, for each of these n_1 possible outcomes, there are n_2 possible outcomes of the second experiment; and if, for each of the possible outcomes of the first two experiments, there are n_3 possible outcomes of the third experiment; and if . . . , then there is a total of $n_1, n_2, \dots, n_r$ possible outcomes of the r experiments.

Note

With replacement means that after the first number is picked it is replaced in the set of numbers, so it could be picked again as the second number.

4.1.4 Permutations

A permutation ("arrangement number" or "order") is an arrangement of the elements of an ordered list.

Factorial Notation

$x! = x \times \ldots \times 1$: represents cases where each event may only occur once, so the number of possible of choices decreases each time.

$n^{(k)} = \frac{n!}{(n-k)!}$: represents cases where only a certain number of events can be chosen from the initial options.

Note : Order is important!