MATH 440 Lecture 4

Chris Camano: ccamano@sfsu.edu

2/17/2022

Combinatorics

Multiplication rule and summation rule
multiplication rule Assume you have some operation or some object that can be chosen in n ways:

$$A_1, A_2, ..., A_k$$

Each with

$$n_1, n_2, ..., n_k$$

different ways of being selected. .

Rule of Sum When you have different events A and B with n ways for A and m ways for B you can find the combinations by summing the different ways.

$$\text{or } \rightarrow \textbf{rule of sum}$$

$$\textbf{and } \rightarrow \textbf{Multiplication rule}$$

permutations

Given an ordered arrangement of some objects of length k which are selected from a finite collection of objects (size n) is called a permutation:

$$nP_k = \frac{n!}{(n-k)!}$$

counting permutations with repetitions

The number of ways to arrange n objects such that n_1 being of one kind n_2 being of second time.... such that $n_1 + ... + n_r = 1$ is

$$N = \frac{n!}{\prod_{i=1}^{r} n_i!}$$

Combinations

$$\binom{nC_r = n}{k = \frac{n!}{(n-k)!k!}}$$

Binomial Coefficients

Property of Pascal's triangle

$$\binom{n}{k} = \binom{n}{k-1} + \binom{n}{k+1}$$

Multinomial Coefficients

Given

$$(x_1 + x_2 + .. + x_r)^n = \sum_{n_1} + \sum_{n_2} + ... + \sum_{n_r} \frac{n!}{\prod_{i=1}^{r} n_i!} \prod_{j=1}^{i} x_j^{n_j}$$