Probability Methods in Engineering

CSE-209

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Lecture 5

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Counting Methods

- Sampling without replacement without ordering
  - k draws from n objects
  - Combinations
- Sampling with replacement without ordering
  - k draws from n objects
  - Object replaced after draw

Examples

- Find the number of ways of selecting two objects from $A = \{1, 2, 3, 4, 5, 6\}$
  - Without regard to order
  - With regard to order

Examples (cont.)

- Find the number of distinct permutations of
  - Balls labeled 1, 2, 3 and 4
  - 2 white balls and 2 black balls
  - 3 white balls and 2 black balls

Examples (cont.)

- A set of 6 laptops contains 3 defective ones. Suppose 4 of them are selected at random and checked. What is the probability that 2 of the defective laptops are selected?

Examples (cont.)

- A batch of 10 items contains 4 defective items. Suppose 5 items are selected at random and tested. What is the probability that exactly 2 of the items tested are defective?

Counting Methods (cont.)

Sampling with replacement without ordering

- n objects and k draws
- k can be greater than n
- Make a table of x's and /'s
  - E.g. the number of objects, n = 4 and draws, k = 5

Object 1	Object 2	Object 3	Object 4
xx	/	/ x /	xx

- In summary, xx//x/xx
- n - 1 /'s and k x's
- So the number of different arrangements would be

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

Counting Methods (cont.)

Sampling with replacement without ordering

- Three balls placed in an urn are labeled as 1, 2 and 3. Five draws are performed in such a way that ball is placed back in the urn after each draw. Find the number of possible outcomes of this random experiment.