## Permutation and Combination Examples

## Example:

- The number of ways of obtaining an ordered subset of $r$ elements from a set of $n$ elements is given by

$$
n P r=n!/(n-r)!
$$

e.g., 5 people with 3 chairs: number of permutations (scenarios) they can sit:

$$
5 \times 4 \times 3=60
$$

(order is important)

## 0! Definition

- Mathematicians defined it as $0!=1$
- Why? $n{ }^{n} n=n!/(n-n)!=n$ !


## Combination

- Order is not important!
- $n C r=n!/(r!(n-r)!)$
- Example: : 4 coin tosses, fair coin
- 2Heads = HHTT, HTHT, HTTH, THTH, THHT, TTHH
- $4 \mathrm{C} 2=4!/(2!2!)=4 \times 3 / 2=6$


## Binomial Distribution

- Example: 5 coin tosses, fair coin: $P(H)=1 / 2=P(T)$
- $P($ No heads $)=1 / 32=5 \mathrm{Co} / 32$
- $P(1$ head $)=5 \mathrm{C}_{1} / 32=(5!/ 4!) / 32=5 / 32$
- $\mathrm{P}(2$ heads $)=5 \mathrm{C} 2 / 32=(5!/(2!3!) / 32=10 / 32$
- $P(3$ heads $)=5 C 3 / 32=10 / 32$
- $\mathrm{P}(4$ heads $)=5 \mathrm{C} 4 / 32=5 / 32$
- $P(5$ heads $)=5 C 5 / 32=1 / 32$
- We use combination because order is not important

