

M118 SECTION 7.4 – PERMUTATIONS AND COMBINATIONS

1) When using the multiplication principal we've encountered

$$26 \cdot 25 \cdot 24 \quad \text{or } 8 \cdot 7 \cdot 6 \cdot 5 \text{ etc.}$$

For a natural number $n! = n(n-1)(n-2)(n-3)\dots(2)(1)$

$$4! = 4(3)(2)(1)$$

$$0! = 1$$

$$n! = n(n-1)$$

Ex. $6! = 6(5)(4)(3)(2)(1) = 720$

$$\frac{10!}{6!} = \frac{10(9)(8)(7)(6)(5)(4)(3)(2)(1)}{(6)(5)(4)(3)(2)(1)} = 10(9)(8)(7)$$

$n!$ grows very fast

$$5! = 120 \quad 10! = 3,628,800 \quad 15! = 1,307,674,368,000$$

PERMUTATION: A permutation is a set of distinct objects in an arrangement of the objects in a specific order without repetition.

$$\text{A SET OF 4 PICTURES ON A WALL} \quad 4 \cdot 3 \cdot 2 \cdot 1 = 24$$

The number of permutations of n distinct objects

$${}_n P_n = n(n-1)(n-2)(n-3)\dots 2(1) = n!$$

$${}_5 P_5 = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 5! = 120$$

Now suppose we only want to hang 2 out of the 4 pictures – How many ways can we do that?

That would be the number of permutations of 4 things taken 2 at a time or

$${}_4 P_2 = 4 \cdot 3 \text{ or } \frac{4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = \frac{4!}{2!}$$

In general the number of permutations of n things taken r at a time is

$${}_n P_r = \frac{n!}{(n-r)!} \quad {}_5 P_3 = \frac{5!}{2!} = 5 \cdot 4 \cdot 3 = 60$$

b) How many ways can we choose a sub committee of 4 people from a group of 12 people?

We will be asking questions about decks of cards – if you are not familiar there is a handout that I can give you.

52 cards	4 suits	13 hearts	A, 2, 3... 10, J, Q, K
		13 spades	A, 2, 3... 10, J, Q, K
		13 clubs	A, 2, 3... 10, J, Q, K
		13 diamonds	A, 2, 3... 10, J, Q, K

How many 5 card hands will have 3 hearts and 2 spades?

How many serial numbers are 3 letters followed by three digits?

#34

Nine cards are numbered with the digits from 1 to 9. A 3-card hand is dealt, 1 card at a time. How many hands are possible where

a) Order is not taken into consideration. _____

b) Order is not taken into consideration. _____

#38

From a standard 52-card deck, how many 5-card hands will have all face-cards? _____

All face cards, but no kings? _____

#42

Three departments have 12, 15, and 18 members, respectively. If each department is to select a delegate and an alternate to go to a conference, how many ways can this be done?

#56

How many 4-person committees are possible from a group of 9 people if

- a) There are no restrictions? _____
- b) Both Jim and Mary must be on the committee? _____
- c) Either or Jim or Mary (but not both) must be on the committee? _____

#62 An electronics store receives a shipment of 30 calculators, including 6 that are defective. Four of these calculators are selected to be sent to a school.

- a) How many selections can be made? _____
- b) How many of these selections will contain no defective calculators?

#66

A 4-person grievance committee is to be selected from 2 departments, A and B, with 15 and 20 people, respectively. In how many ways can the following committees be selected?

- a) 3 from A and 1 from B _____
- b) 2 from A and 2 from B _____
- c) All from A _____
- d) 4 people regardless of department _____
- e) at least 3 from department A _____