MA 12 LG 15 (Combinatorics)

1.1 The Fundamental Counting Principle

If all combinations = a × b × c × ...

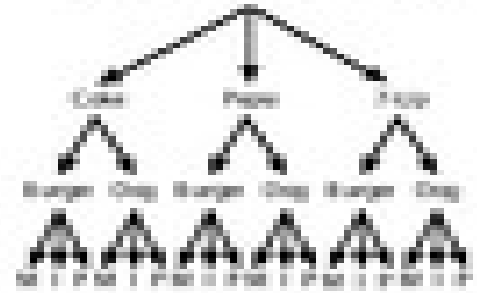
where a, b, c, are the number of choices in each category

Example for 1.1

Draw a tree diagram to list all the possibilities for the following:

How many different combinations can be made from:

Drinks	Dinners	Desserts
Coke	Burger	Ice cream
Pepsi	Hot Dog	Pie
7-Up		



# of Combos = 3 × 2 × 3 = 18 combos

1.2 Permutations

Factorial: $n! = n(n-1)(n-2)(n-3)\ldots 1$

Permutations (order is important) also is different from with

$$\text{Permutations} = \frac{n!}{(n-r)!} \qquad n = \text{\# of objects}$$

$a, b, c, \ldots$ = # of objects alike

$$nP_r = \frac{n!}{(n-r)!}$$

Example for 1.2

Express in factorial notation:

8 × 7 × 6 × 5 × 4 × 3 × 2 × 1 = 8!

Example for 1.21

Express as a product of natural #'s in reduced form:

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

Example for 1.22

Express $12 \times 11 \times 10 \times 9 \times 8$ in the form $_nP_r$

$$12 \times 11 \times 10 \times 9 \times 8 = \frac{12!}{7!} = {}_{12}P_5$$

$n = 12 \quad r = 5$

1.3 Combinations

Factorial: $n! = n(n-1)(n-2)(n-3)\ldots 1$

$$nP_r = \frac{n!}{(n-r)!}$$

Combinations (order isn't important) also is same as with

$$nC_r = \frac{nP_r}{r!} = \frac{n!}{r!(n-r)!}$$

Example for 1.31

Express as a product in reduced form:

$$_{10}P_3 = \frac{10!}{(10-3)!} = \frac{10!}{7!} = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1} = 10 \times 9 \times 8 = 720$$

$$_{10}C_3 = \frac{10!}{(10-3)!3!} = \frac{10!}{7!3!} = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 \times 3 \times 2 \times 1} = \frac{10 \times 9 \times 8}{3 \times 2 \times 1} = 10 \times 3 \times 4 = 120$$