Basics of Counting:

The two basic counting principles are

1. The product rule 2. The sum rule

The product rule:

If one job can be done in 'm' ways and following this another job can be done in 'n' ways then the total number of ways in which both the job can be done in the stated order is mn.

The Sum rule: If one job can be done in m ways and another job can be done in 'n' ways and if there is no way common to both jobs then the total no. of ways in which either of the two jobs can be done is equal to m + n.

Product rule: problems:

1) How many different bit strings of length seven are there?

Soln: Each of the seven bits can be chosen in two ways because each bit is either 0 or 1. ∴ The total number of seven digit number is equal to

$$2.2.2.2.2.2.2 = 2^7 = 128.$$

2. How many different 8 bit strings are there that begin and end with 1?

Soln:

1 x x x x x x 1

A 8 bit string that begin and end with 1 can be constructed in 6 steps.

Each bit marked X can be selected in 2 ways. Hence, the total no. of 8 bit strings that begin and end with 1 = 2.2.2.2.2.2 = 2^6 = 64.