MSO 201A: (Probability & Statistics)

References :- i) Mathematical Statistics and Data Analyses (Third Edition) : John A Rice.

ii) Introduction to Mathematical Statistics (Sixth Edition): Hogg . McKean . Craig.

iii) Probability and Statistics for Engineering and the Sciences (Eighth Editim) : Jay L Devore.

The weightage of the marks :- i) Quiz 1 (12%),

ii) Quiz 2 (13%), iii) Mid semester examination (30%).

iv) End Semester Examination (45%).

A few examples where prob. can be applied:-

i) In genetics as a model for mutations.
ii) The kinetic theory of gas.
iii) Noise in Electrical devices.
iv) Atmospheric turbulance.
v) Actuarial Scienc.
vi) Theory of finance.

Note:- In those applications, one may face various type of data.

For example, i) scalar valued data (height of an individual).
ii) Multivariate data ((height, weight) of an individual).
iii) sequence data (DNA sequence of an individual).
iv) Functional data (Rainfall in a city (day wise) over 100 years)

v) Infinite dimensional data :- When data object lying in infinite dimensional space (Sequence data / functional data can be a "perfect" example of infinite dimensional data).

Random experiment :-

i) All possible outcomes of an experiment are known in advance.

ii) Outcome of a particular trial is not known.

iii) Can be repeated under "identical" condition.

Sample space :- Set of all possible outcomes of a random experiment. In literature, it is generally denoted by Ω.

A few real examples :—

1. Suppose that a person is walking on the road. And there are three signals (Each of them either green or red).

Green :- Continue (denoted by c) & Red :- Stop (denoted by s).

In this example :- $\Omega = \{ccc, ccs, css, csc, sss, ssc, scc, scs\}$.

2. The number of jobs in a print queue.

Here, the sample space will be

$$\Omega = \{0, 1, 2, 3, \ldots\}.$$

If there is an upper limit N, we then have

$$\Omega = \{0, 1, \ldots, N\}.$$

Event:- It is a subset of Ω (i.e., sample space). (can be denoted by $A, B, C \cdots$).

Two definitions:-

Mutually exclusive events:- A and B are mutually exclusive if $A \cap B = \phi$.

Mutually Exhaustive events:- If $A_1, A_2, \cdots, A_n$ are mutually exhaustive events if $A_1 \cup A_2 \cdots \cup A_n = \Omega$.

Notational facts:-

A^c :- Complement of A.

$A \cup B$: A union B (can be extended for finitely many cases).

$A \cap B$:- A intersection B (can be extended for finitely many cases).

ϕ : Empty set (No element).

A few more facts :-

i) Commutative law :- $A \cup B = B \cup A$

$A \cap B = B \cap A$.

ii) Associative law :- $(A \cup B) \cup C = A \cup (B \cup C)$.

$(A \cap B) \cap C = A \cap (B \cap C)$.

iii) Distributive law :- $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$.

$(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$.

A few examples of event:-

Example related to sample space:-

Event A:- The person will stop (s) at the first signal.

$A = \{sss, ssc, scc, scs\}$.