Statistics Notes (II)

Contents

1 Probbility

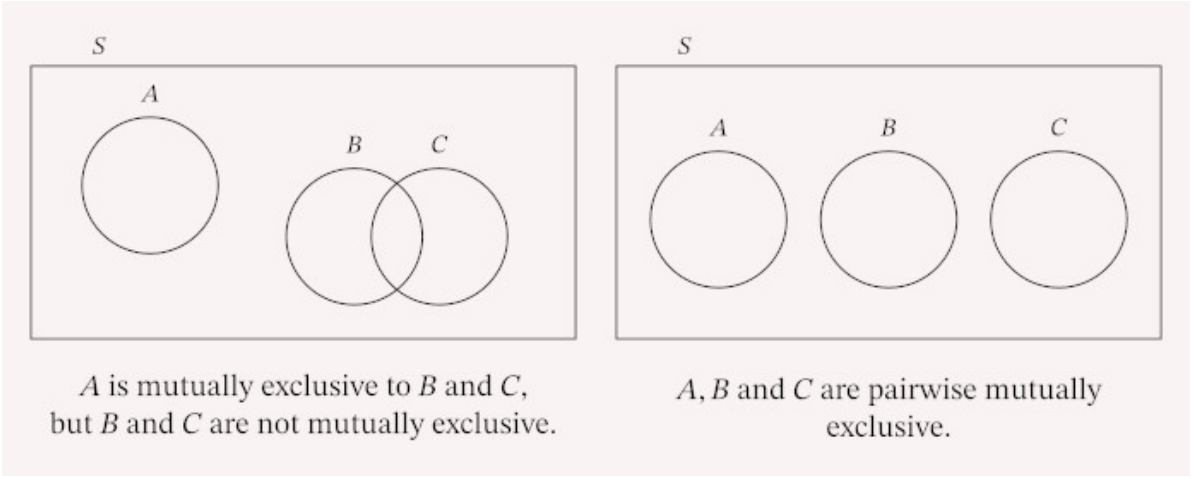
1.1 Important Concepts

1.1.1 Terms

Trial A single performance of well-defined experiment Experiment
a scientific test in which you perform a series of actions and carefully observe their effects in order to learn about something. or *An act that can be repeated under some specific condition.* Random variable
A variable whose values are associated with probability. Sample space
Set of all possible outcomes of a random experiment Sample point
Each outcome of a sample space Event
Any subset of a sample space Simple event
An event having a single outcome Compound/Composite event
An event having more than one outcome Impossible event
An event which cannot happen (If P(A) = 0, then A is an impossible event) Certain event
An event which surely will or will not happen. (P(A) = 0 or 1)

Uncertain event An event which may or may not happen ($0 < P(A) < 1$)

Mutually Exclusive Event Events that cannot occur together. If $S = \{1, 2, 3, 4\}, A = \{1, 3\} \& C = \{4\}$ then A & B are mutually exclusive.



A is mutually exclusive to *B* and *C*, but *B* and *C* are not mutually exclusive.

A, *B* and *C* are pairwise mutually exclusive.

Independent Event Events that do not affect each other.

Complementary event Non-occurence of an event. $P(\bar{A}) = 1 - P(A)$, where $\bar{A}$ or A' or A^c is called complement of A.

Exhaustive event Events whose union is equal to the sample space of the experiment (all outcomes are considered)

Equally likely events Events having same probability. If $S = \{1, 2, 3\}, P(1) = P(2) = P(3) = 1/3$, here 1, 2, and 3 are equally likely. One way for them not to be equally likely is: $P(1) = 1/2, P(2) = 1/5, P(3) = 1/4$

1.1.2 Set Theory

NB: This is far from a comprehensive discussion of the set theory.

Set Operations

Suppose, $A = \{1, 3, 4\}$ and $B = \{3, 4, 5\}$

- Union: A or B $\Rightarrow A \cup B = \{1, 3, 4, 5\}$
- Intersection: A & B $\Rightarrow A \cap B = \{3, 4\}$
- Difference: $A - B = \{1\}$

Laws of Set

a. Cumulative law: $A \cup B = B \cup A$ and $A \cap B = B \cap A$

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

c. Distribution law: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ and $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

d. De Morgan's law:

   i. $(A \cup B)' = A' \cap B'$
   ii. $(A \cap B)' = A' \cup B'$

Verify De Morgan's law

S = {1, 2, 6, 8}; A = {1,4}; B = {2,6}

1.1.3 Permutaion

Permutaion is all about arranging items, while combination is used to find the ways to to select items.

If we have 3 items A, B, and C; we can arrange them in the following way.

- ABC
- ACB
- BAC
- BCA