L.5 Measures of variation

Coefficient of quartile: is a measure of dispersion, which is used to describe the spread or distribution of data. It is calculated as follows:

Coefficient of quartile deviation = (Q75 – Q25) / (Q75 + Q25)

Example:

A = {2, 4, 6, 8, 10, 12, 14}

n = 7, range = 12, mean = 8, median = 8, Q_1 = 4, Q_3 = 12,

Quartile coefficient of dispersion = 0.5

B = {1.8, 2, 2.1, 2.4, 2.6, 2.9, 3}

n = 7, range = 1.2, mean = 2.4, median = 2.4, Q_1 = 2, Q_3 = 2.9,

Quartile coefficient of dispersion = 0.18

The quartile coefficient of dispersion of data set A is 2.7 times as great (0.5 / 0.18) as that of data set B.

The probability

Probability means possibility, deals with the occurrence of a random event. The value is expressed from zero to one. It used to predict how likely events are to happen.

Probability can range from 0 to 1, where 0 means the event to be an impossible one and 1 indicates a certain event.

For example, when we toss a coin, either we get Head OR Tail, only two possible outcomes are possible (H, T). The probability of a head in any single flip of the coin

equals 1/2 . But when two coins are tossed then there will be four possible outcomes, i.e {(H, H), (H, T), (T, H), (T, T)}.

Probability of event to happen P(E) = Number of favourable outcomes/Total Number of outcomes

ex- There are 6 pillows in a bed, 3 are red, 2 are yellow and 1 is blue. What is the probability of picking a yellow pillow?

Ans: The probability is equal to the number of yellow pillows in the bed divided by the total number of pillows, i.e. 2/6 = 1/3.

Probability of an Event

Assume an event E can occur in **r** ways out of a sum of **n** probable or possible **equally likely ways**. Then the probability of happening of the event or its success is expressed as;

P(E) = r/n

The probability that the event will not occur or known as its failure is expressed as:

P(E') = (n-r)/n = **1-(r/n)**

E' represents that the event will not occur.

Therefore, now we can say;

P(E) + P(E') = 1

This means that the total of all the probabilities in any random test or experiment is equal to 1.

ex: A vessel contains 4 blue balls, 5 red balls and 11 white balls. If three balls are drawn from the vessel at random, what is the probability that the first ball is red, the second ball is blue, and the third ball is white?

Solution:

The probability to get the first ball is red or the first event is 5/20.

Since we have drawn a ball for the first event to occur, then the number of possibilities left for the second event to occur is 20 – 1 = 19.

Hence, the probability of getting the second ball as blue or the second event is 4/19.

Again with the first and second event occurring, the number of possibilities left for the third event to occur is 19 – 1 = 18.

And the probability of the third ball is white or the third event is 11/18.

Therefore, the probability is 5/20 x 4/19 x 11/18 = 44/1368 = 0.032.

Or we can express it as: P = 3.2%.

ex: Two dice are rolled, find the probability that the sum is:

1. **equal to 1**
2. **equal to 4**
3. **less than 13**

Solution:

To find the probability that the sum is equal to 1 we have to first determine the sample space S of two dice as shown below.

S = { (1,1),(1,2),(1,3),(1,4),(1,5),(1,6)

(2,1),(2,2),(2,3),(2,4),(2,5),(2,6)

(3,1),(3,2),(3,3),(3,4),(3,5),(3,6)

(4,1),(4,2),(4,3),(4,4),(4,5),(4,6)

(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)

(6,1),(6,2),(6,3),(6,4),(6,5),(6,6) }

So, n(S) = 36

1) Let E be the event “sum equal to 1”. Since, there are no outcomes which where a sum is equal to 1, hence,

P(E) = n(E) / n(S) = 0 / 36 = 0

2) Let A be the event of getting the sum of numbers on dice equal to 4.

Three possible outcomes give a sum equal to 4 they are:

A = {(1,3),(2,2),(3,1)}

n(A) = 3

Hence, P(A) = n(A) / n(S) = 3 / 36 = 1 / 12

3) Let B be the event of getting the sum of numbers on dice is less than 13.

From the sample space, we can see all possible outcomes for the event B, which gives a sum less than B. Like:

(1,1) or (1,6) or (2,6) or (6,6).

So you can see the limit of an event to occur is when both dies have number 6, i.e. (6,6).

Thus, n(B) = 36

Hence,

P(B) = n(B) / n(S) = 36 / 36 = 1

Probability questions

1. Two dice are thrown together. Find the probability that the product of the numbers on the top of the dice is:
   (i) 6 (ii) 12 (iii) 7
2. A bag contains 10 red, 5 blue and 7 green balls. A ball is drawn at random. Find the probability of this ball being a
   (i) red ball (ii) green ball (iii) not a blue ball