13.03.2022

{
1) Concept of Bayes' theorem using some example.

2) Concept of Sampling Techniques using some example.

3) Testing of Hypothesis.
}

Probability

Prior (which is known from the given information)

Posterior (which we have to compute on the basis of Prior information)

Covid-19.

10000

5000 — Age group below 30 — ϕ_1

3000 — 30 - below 50 — ϕ_2

2000 — 7,50 — ϕ_3

Group	No. of infected	No. of death
G_1 (< 30)	5000	5
G_2 (31 - 49)	3000	15
G_3 (>, 50)	2000	40
	$\sum = 10000$	60

$$P(D) = \frac{60}{10000} = 0.6\%$$

unconditional

Prob.

1) Conditional

2) unconditional

Prior.

$$P(D / G_1) = 5/5000 = 0.1\%$$

$$P(D / G_2) = 15/3000 = 0.5\%$$

$$P(D / G_3) = 40/2000 = 2\%$$

Prior.

$$P(G_1) = \frac{5000}{10000} = 1/2$$

$$P(G_2) = \frac{3000}{10000} = 3/10$$

$$P(G_3) = \frac{2000}{10000} = 2/5$$

|| Prob is To predict future on the basis of past.

Calculate the chance of death from group 1, group 2 & group 3.

Known	Unknown
$P(G_1) = 1/2$, $P(G_2) = 3/10$, $P(G_3) = 1/5$ $P(D) = 0.6\%$ $P(D/G_1) = 0.1\%$ $P(D/G_2) = 0.5\%$, $P(D/G_3) = 2\%$	$P(G_1/D) =$ $P(G_2/D) =$ $P(G_3/D) =$

Table showing the calculation of posterior prob.

$④ = ② \times ③$

i ①	② $P(G_i)$	③ $P(D/G_i)$	$P(G_i)P(D/G_i)$	$P[G_i/D]$
1	$1/2$	$1/1000$	$1/2000$	$\frac{1/2000}{60/10000}$
2	$3/10$	$5/1000$	$15/10000$	$\frac{15/10000}{60/10000}$
3.	$1/5$	$2/100$	$2/500$	$\frac{2/500}{60/10000}$

$$\frac{5+9}{10000}$$

$$\sum P(G_i)\,P(D/G_i) = \frac{60}{10000} = 0.6\%$$

$$P(D) = P(G_1)P(D/G_1) + P(G_2)P(D/G_2) + P(G_3)P(D/G_3)$$

$\therefore P(G_1/D) = 1/12 = 8\%$

$P(G_2/D) = 1/4 = 25\%$

$P(G_3/D) = 2/3 = 67\%$

100%

$P(G_1/D) + P(G_2/D) + P(G_3/D) = 1$

Stock: Reliance:

60 members

min

Q1

Q2

Q3

max

60

		freq
G1	min - Q1	10
G2	Q1 - Q2	22
G3	Q2 - Q3	28
G4	Q3 - max	10
		60

$P(G_1) = 10/60$

$P(G_2) = \quad P(G_3)$

$P(G_4)$

Mean

variance.

$$\bar{x} = \frac{x_1 f_1 + x_2 f_2 + \dots + x_n f_n}{N} = \frac{\sum x_i f_i}{N}$$

$$= x_1 \frac{f_1}{N} + x_2 \frac{f_2}{N} + \dots + x_n \frac{f_n}{N}$$

$$= x_1 p_1 + x_2 p_2 + \dots + x_n p_n$$

$$E(X) = \sum x_i p_i$$

mean of X

5 W
4 B

3 balls are drawn

1 W + 5 Rs

1 B − 7 Rs

$$TNC = \binom{9}{3} = \frac{9 \times 8 \times 7}{6} = 84$$

$$FNC = \binom{5}{3} = 10$$

$$p_1 = \frac{10}{84}$$

$$p_2 = \frac{({}^5C_2)({}^4C_1)}{84} = \frac{40}{84}$$

$$p_3 = \frac{({}^5C_1)({}^4C_2)}{84} = \frac{30}{84}$$

$$p_4 = \frac{({}^4C_3)}{84} = \frac{4}{84}$$

x_1 → 3 white = 15

x_2 → 2 W + 1 B: $10 - 7 = 3$

x_3 → 1 W + 2 B: $5 - 14 = -9$

x_4 → 3 B

$$x_1 = 15 \quad x_2 = 3 \quad x_3 = -9 \quad x_4 = -21$$

$$p_1 = \frac{10}{84} \quad p_2 = \frac{40}{84} \quad p_3 = \frac{30}{84} \quad p_4 = \frac{4}{84}$$

$$p_1 + p_2 + p_3 + p_4 = 1$$

$$E(X) = x_1 p_1 + x_2 p_2 + x_3 p_3 + x_4 p_4$$

$$= 15 \times \frac{10}{84} + 3 \times \frac{40}{84} - 9 \times \frac{30}{84} - 21 \times \frac{4}{84}$$

$$= \frac{1}{84}(150 + 120 - 270 - 84$$

$$= \frac{1}{84}(270 - 270 - 84)$$

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

$= -1$

Variance $= \frac{1}{54}\sum (x_i - \bar{x})^2 f_i$

$= \frac{1}{54}\sum x_i^2 f_i - \bar{x}^2$.

$= x_1^2 \frac{f_1}{N} + x_2^2 \frac{f_2}{N} + \dots + x_n^2 \frac{f_n}{N} - \bar{x}^2$

$= x_1^2 p_1 + x_2^2 p_2 + \dots + x_n^2 p_n - (E(x))^2$

$= \sum x_i^2 p_i - (E(x))^2$

$$\boxed{V(x) = E(x^2) - (E(x))^2}$$

$E(x^2) = x_1^2 p_1 + x_2^2 p_2 + x_3^2 p_3 + x_4^2 p_4$.

$= 15^2 \times \frac{10}{84} + 3^2 \times \frac{40}{84} + (-9)^2 \times \frac{30}{84} + (-21)^2 \times \frac{4}{84}$

$= \frac{1}{84}\left[2250 + 360 + 2430 + 1764\right]$

$= \cancel{7.88}$ $\quad 80.88$

$V(x) = E(x^2) - (E(x))^2$

$= 80.88 - (-1)^2$.

$= 79.88$

$SD(x) = 8.9$

Sampling. (w. Imp)

Deterministic

Probabilistic

Random.

2 2 2 2 2

2

2 2 2 2 2

1

2

Risk =

Risk is vers

BIG Data

3D

volume.

Velocity

variation

7 D.

West Bengal

RTPCR.

N = 60600

600

Total no of Cases = 60000.

C.

Possible to compute

600

400

5 Person A B C D E.

2 Person

$({}^5C_2) = 10$

AB AC AD AE 4
BC BD BE 3
CD CE 2
DE 1

10

6000
600
600

Random Sampling Technique

to draw 600 Sample.

Simple random Sample with replacement (SRSWR)

Simple random Sample without replacement (SRSWOR)

N = 1, 2, 3, 4.

n = 2

	1	2	3	4
1	11	12	13	14
2	21	22	23	24
3	31	32	33	34
4	41	42	43	44

12 = 21.

12 ≠ 21.

12 ≠ 21.

No. of cases in WR $= 4^2 = 16$

No. of cases in WOR $= ({}^4P_2)$
$= 12$

P[of selecting 2 member in SRSWR)

$= \frac{1}{16^2} = \frac{1}{\quad}$

P[of selecting 2 member in SRSWR]

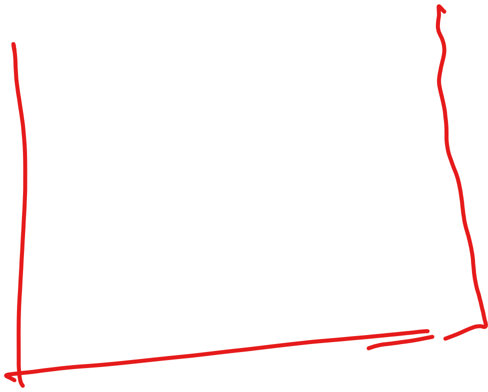
$= \frac{1}{16} \times \frac{1}{16}$

$N = 4$. $n = 2$.

P[of drawing n members out of N]

$= \frac{1}{N} \cdot \frac{1}{N} \cdots \frac{1}{N}$

1000



$= \frac{1}{N^n} = \frac{1}{4^2} = \frac{1}{16}$

P[Getting 1st Prize] $= 1/1000$

P[Getting 2nd "] $= 1/999$

P[" "] $= 1/998$

P["

WOR.

50

WR

SRSWR.

Bootstrapping.

$N = 4$. $n = 2$ | $N = 60000$. $n = 600$

P[of selecting 'n' members out of N]

P[of selecting 2 members out of 4]

$= \frac{1}{N} \cdot \frac{1}{N} \cdot \frac{1}{N} \cdots \frac{1}{N} = \frac{1}{N^n} = \frac{1}{4^2} = \frac{1}{16}$

n times.

SRSWR

P[of selecting 'n' members out of N in SRSWOR]

$= \frac{1}{N} \cdot \frac{1}{N-1} \cdot \frac{1}{N-2} \cdots \frac{1}{N-(n-1)} = \frac{1}{(^N P_n)}$.

Testing of Hypothesis.

↓

Estimation

↓

Sampling.

↓

Distribution → Random variable

Prob.

Philips.

manufactures Electrical Bulbs?

⇓

Producer

Consumer.

Producer / Seller | Buyer / Customer / User.

Distributor

D_1 D_2

R_1 . . . R

Avg. Burning hrs of the Tube $\geq$ 1000 hrs

Avg Burning hrs < 1000

1000

pop^n

Avg philips

H

Tubes

Avg. Burning hrs = μ

μ = population mean

$x \geq 1000$ → meaningless

$x < 1000$

$x = 1000$

$x = 2$

$x < 2$

$x > 2$

Simplification

$x = 1000$

$x < 1000$

Statement made by divided into two parts.

App.

Alternate

Info

Producer

Consumer

① Composite

② Simple

one sided

both sides

(which is not simplified)

$x \geq 1000$

$x < 1000$

$x = 1000$

$x < 1000$