Mid-II

21/03/2022

Box Plot: (Presentation)

↳ also called five points summary plot -

⇒ Measure of Central Tendency & Dispersion

↳ 5 points are: (values)

① Q_1
② Median
③ Q_3
④ $Q_1 - 1.5IQR$ → Below 1.5IQR → outlier
⑤ $Q_3 + 1.5IQR$ → Above 1.5IQR → outlier

Suppose data is,

1
2
3
4
5

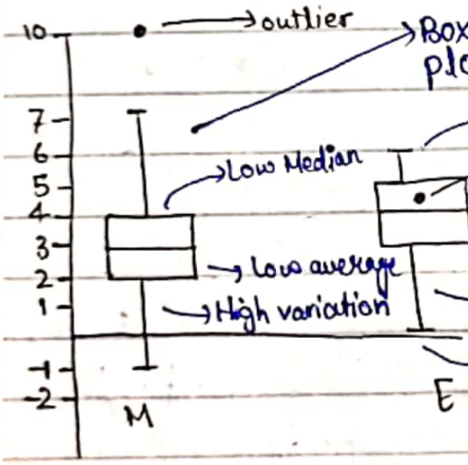
IQR nikal kar phir values main put krna

$\boxed{IQR = Q_3 - Q_1}$

then,

① $Q_1 = 2$
② Median $= 3$
③ $Q_3 = 4$
④ $Q_1 - 1.5IQR = -1$
⑤ $Q_3 + 1.5IQR = 7$

↳ We can draw box plot for any Quantitative Data



↳ It is for Quantitative Data
↳ For Descriptive Data

⇒ samajhna → (Median + IQR)

↳ better for skewed-data plot

↳ Isky 5 points summary ~~statistics~~ main ata hain isky 5 points ko present kr rahay jo data ki characteristics ko btaty hain

↳ If comparison is not possible then absolute. For example, marks in matric 1021 plus CGPA (3.1) can't be compared. In order to compare we should convert them to % (Relative).

→ currency is relative

Weight: $\bar{X} = 61kg$, SD: 2kg

Height: $\bar{X} = 5.6ft$, SD: 1.1ft

→ STD is absolute measure (not comparable)
→ Agr inky units same bhi kr lain phir bhi comparison possible nhi

Coefficient of Variation: (For STD) → Mean

(normalized) $C.V = \frac{S.D}{\bar{X}} \left(\frac{kg}{kg}\right) \times 100$ (Unitless)

↳ ku k data k centres change

normalizing w.r.t mean and ending its effect

$C.V = 3.278\%$ (Weight)

→ In terms of percentage

Variation ↑ then consistency ↓ | us player ko team main rkhna jo consistent hoo |

$C.V = 19.64\%$ (Height)

→ Height ki variation zida hai

normalizing GPA $\frac{3.1}{4}$ $\frac{1021}{1100} \times 100$ → normalizing matric marks with total 1100 to eradicate its effect

↳ Relative measurement for STD is called Coefficient of Variation (C.V).

Coefficient of IQR: (For IQR) → Median

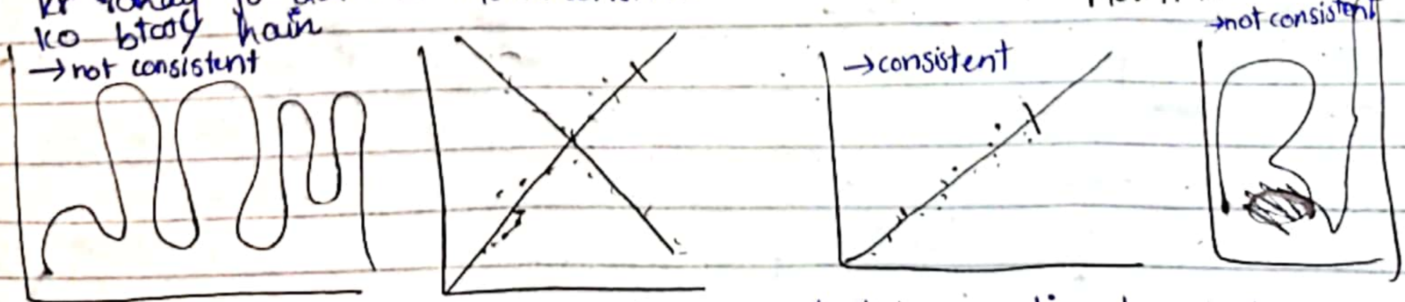
↳ Just like coefficient of Variation

$$\text{Coefficient of IQR} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

→ total sy divide normalized krny k liye

Coefficient of Range: (For Range) → Mode

$$\text{Coefficient of Range} = \frac{Max - Min}{Max + Min}$$



→ normal data main mean aur median same ata hai issy liye hum unky variation ko is k through study kr skty

Question: Agr coin toss kia aur Head aya to phir ghr main khelna aur Tail aya to bahir khelny jana aur agr stand hoogya to phir pharhai krna -
Ans: Probablity of studying = 0 (Because coin standing does not exist in sample space).

```
y = runif(100,10,100)
hist(y)
summary(y)
mean(y)
```

04/02/2022

⇒ **Probablity**
↳ Death (certain)
↳ Death kab aye gi (uncertain)
↳ kal kia hoo skta (possibility)
↳ kal kia hoo ga (no one knows)

↳ uncertainity
↳ Probablity is the measure of chances of uncertainity. or Quantification of uncertainity
↳ Probablity started in 17's when rich people wanted to know their chances of winning gambling so they hired intelligent mathematicians
↳ 1 bar ek rocket launch hooty hy tabah hoogya uski jab probablity nikali gye. to phir wo 0.001% thi tab sy har field main almost 40% probablity use hooti
↳ Patient chances of recovery (probablity)
↳ Rain Forecasting (probablity of rain)

~~Data → Algorithm → Probablity~~

→ Agr clothes wash kiye to phir kia chances k baarish hoo

Experiment: (Pre-planned)
↳ Any planned activity is called ~~activity~~ experiment.
↳ observe krna k kon sun raha lecture aur kon nhi (pre-planned)

Random Experiments
In order to convert Experiment to Random Experiment the
① Outcomes are known
② Occurrence are unknown
↳ Dice Throwing ↳ Card nikalna ↳ Bowling
↳ Probablity hamesha random experiment ki nikalti hai
↳ Random experiment hoony k liye experiment hoona zrori hai ↳ Coin tossing

Sample Space: → Jahan per sab kuch available hoo
Gather all possible results of random experiment in a set.

$S = \{H, T\}$ ⟶ Toss
$S = \{1,2,3,4,5,6\}$ ⟶ Dice

→ Mathematical Probablity
→ Mathematical Concept

Outcome:
Each element of the sample space is called an outcome
↳ Result of ~~Sample Space~~ Random Experiment is called an outcome

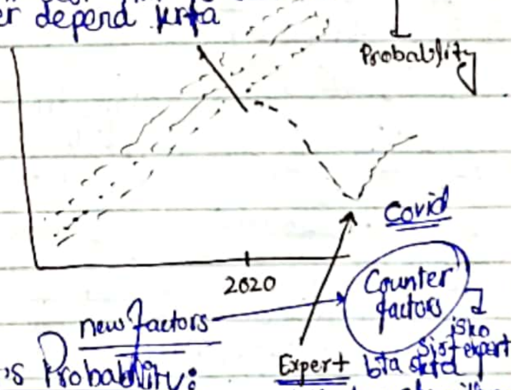
Event: ↳ Agr batting team ki taraf to hum 6 main interested hoongy
↳ Outcomes in which we are interested is called an event.
(in 4 main phir wards → interested)
↳ Yeh humara event hai
↳ Head aya to main jeeta to phir Head mera event hai

2 Approaches to measure Probablity:

Jab data available nhi to phir → Subjective
Objective

Subjective:
↳ Biased expert opinion
not neutral expert measuring chances of PAK vs IND (40%, 60%, 20%)
⇒ Dono main sy koi bhi best nhi ye scenario per depend krta

Objective: data → Algorithm → Probablity



Event's Probablity:
$0 \leq P(A) \leq 1$
↳ Probablity of any event must be between 0 and 1. Agr isky ilawa to phir galat question solve

$\sum_{i=1}^{n} P(A_i) = 1$

Null Event → $P(\cdot) = 0$
Sure Event → $P(\circ) = 1$
→ Tamam events ki probablity ka sum equal to 1 hai

(certain) $P(S) = 1$ ↳ Agr Head aya ya Tail aya to main jeetanga warna main haarunga
(uncertain) $P(\bar{S}) = 0$ ↳ Upr sample space main sub aagye to phir $(\bar{S})$ main us k ilawa sub zero.

↳ If we are interested in whole sample space then probablity is equal to 1

→ Relative Frequency Definition of Probablity

06/04/2022

$P(A) = \dfrac{\text{no. of events}}{\text{total no. of outcomes}} = \dfrac{n(A)}{n(S)}$ → Formula (1)

↳ sample space

52
- 26 (Red)
  - 13 (Diamond)
  - 13 (Heart)
- 26 black
  - 13 (Spade)
  - 13 (Clubs)

→ A coin is tossed

$S = \{H, T\}$

$P(H) = \frac{1}{2} = 0.5$ or $P(T) = \frac{1}{2} = 0.5$

Chances of H – 50% or Chances of Getting $T = \frac{0.5 \times 100}{100} = 50\%$

Diff. between Probablity & Chances:

↳ Probablity is always btw 0 & 1

↳ Chances are in terms of percent (%)

2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K (J, Q, K – Face Cards), A

↳ A dice is rolled

$S = \{1, 2, 3, 4, 5, 6\}$

$P(1) = \frac{1}{6}$

$P(2) = \frac{1}{6}$

⋮

$P(6) = \frac{1}{6}$

Limit: Theory kehti hai k agr 2 baar toss kro to phir 1 baar Head aur 1 baar Tail aye ga lekin ye practically possible nhi lekin agr 1000 baar toss kro aur 500 baar Head aye aur 500 baar Tail to phir ye chez possible hai hence limit

→ Probablity of getting Red $= \frac{26}{52}$

" " " 2 $= \frac{4}{52}$

" " Face cards $= \frac{12}{52}$

↳ Agr 80% chances pass hoonay k to phir agr 100 baar exam dia to phir 80 baar hum pass hoongy (agr wohi conditions hoon un dino main)

↳ Rain chances

Limit:

Ye tab valid hoogi jab n ziada hoojaye

↳ Not face cards

$P(F) = \frac{12}{52}$

$P(\bar{F}) = 1 - \frac{12}{52} = \frac{40}{52}$

→ Dice is thrown

6: {6} except 6: {1, 2, 3, 4, 5}

$P(S) = P(A \cup \bar{A}) = P(A) + P(\bar{A}) = 1$

$\boxed{P(\bar{A}) = (-P(A))}$

0.2 0.8

1 2 3 ∞

$\boxed{-P(\bar{A}) = 1 - P(A)}$ → Formula (2)

Future Events:

Basic LOGIC GATES:

① AND

② OR

→ Not is actually negation

→ Simulation example of tossing by using size of n (changing)

→ R Studio

→ we have to increase our sample space for experiments

→ Stock Market Prediction

Event A, B

→ Agr dono courses main pass hoona to probablity kam

1 over main 6 Sides

↓ chances $P(A \text{ and } B) = P(A \cap B) \longrightarrow \times$

↑ chances $P(A \text{ or } B) = P(A \cup B) \longrightarrow +$

1 over main 1 Side

$0.2 \times 0.3 = 0.06$

$0.2 + 0.3 = 0.5$

→ Agr dono courses main sy 1 course main pass hoona to probablity ziada

	H	T
H	HH	HT
T	TH	TT

Atleast 1 head $= \frac{3}{4}$

Exactly 1 head $= \frac{2}{4}$

(0 or 1 Head) Atmost 1 head

↳ Probablity & possibility are 2 different terms

→ Possibility are ways of happening

→ Agr possibility pta to phir unko divide kr ky probablity aati

→ Possibility (Combination): agr class main sy 2 buchon ko select krna to aur possible combinations

⇒ Sample Space of 2 dices thrown together

	1	2	3	4	5	6
1	11	12	13	14	15	16
2	21	22	23	24	25	26
3	31	32	33	34	35	36
4	41	42	43	44	45	46
5	51	52	53	54	55	56
6	61	62	63	64	65	66

Probablity of getting 1 time 6 $= \frac{11}{36}$

" " " 6 on both $= \frac{1}{36}$

Properties of Events:

If Event A, B

Mutually Exclusive | Not Mutually Exclusive
↳ Mutually inclusive

Independent:

No effect on occurrence of one event on another. Humari degree pass aur England ka President change.

Dependent:

Effects on occurrence of one event on another. Agr 2 students date hoon aur dono ki conveince same.

Mutual → common

① Mutually Exclusive:

Two events A & B are said to be mutually exclusive if they don't occur together. - A coin is tossed - A dice is thrown - A card is extracted - Coin toss kia to phir Head ayega ya Tail lekin dono nhi aa skty

② Non-mutually Exclusive:

Two events A & B are said to be non-mutually exclusive if they can occur together.

↳ also called mutually inclusive

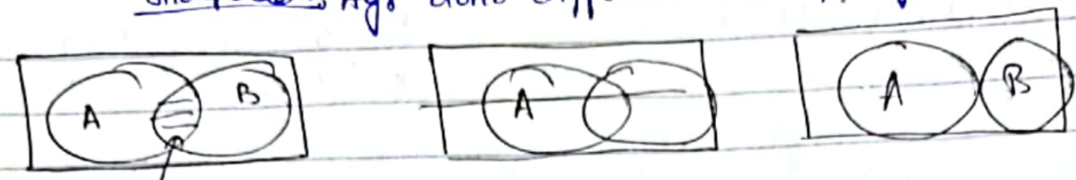
↳ ~~Badal~~ Dhoop aur baarish

↳ Family functions

↳ May be dependent or independent

M·E: Agr 2 students class main late aye aur 1 B section ka aur 1 C section ka (not occurring together)
N·M·E: Agr 2 students A section main late aye then I'm interested in dependent or independent

8/04/2022 **Dependent:** Agr dono 1 conveince per aye
Independent: Agr dono different cities sy aye

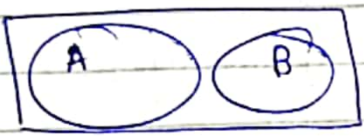


$A \cap B = \emptyset$ then mutually exclusive event

↳ Agr non ME to phir Dependent ya Independent Agr ~~Non~~ ME to phir Dependent ya Independent ka nhi bta skty

M·E: (not occuring together)

$P(A \cup B) = P(A) + P(B)$ (M·E)

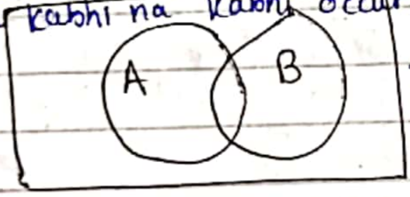


⇒ no common parts

Non·M·E: Kissi bhi situation main 2 akhty aany main interested ya occur ho skty (possible)

Possibility
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

↳ Ho skta us situation main akhty Ana hoon Lekin kabhi na kabhi occur hoo skty hain



→ common part 2 baar aata to balance krny k liye 1 baar substract

↳ Question main M·E or N·M·E ko identify krna aur us hisab sy formula lagana

Independent:

$P(A \cap B) = P(A) \times P(B)$

1) **Dependent:**

Conditional Probablity & Bayers Theorem

Example:

$S = \{1, 2, 3, 4, 5, 6\}$

A : 6 on dice (Event)

B : 1 on dice (Event)

$P(A \cup B) = P(A) + P(B) = \frac{1}{6} + \frac{1}{6} = \frac{2}{6}$

Example:

A : Red Card

B : Face Card

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{26}{52} + \frac{12}{52} - \frac{6}{52} = \frac{32}{52}$

$= 0.615$

Example: (

A : 6 on 1st Dice

B : 6 on second dice

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{1}{6} + \frac{1}{6} - \frac{1}{36}$

$P(A \cap B) = P(A) \times P(B)$

$= \frac{1}{6} \times \frac{1}{6}$

$= \frac{1}{36}$

M·E:

$P(A \cup B \cup C) = P(A) + P(B) + P(C)$

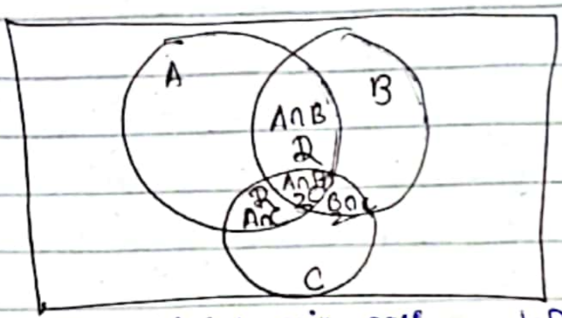
$P(A_1 \cup A_2 \cup A_3 \cup \cdots \cup A_k) = \sum_{i=1}^{k} P(A_i)$

Independent: (Non-M·E)

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

$P(A_1 \cap A_2 \cap \cdots \cap A_k) = \prod_{i=1}^{k} P(A_i)$

$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$



↳ kitny missile fire hoon k target ko fire kny ki probablity 100 percent or maximum considering current factors

↳ Security Purposes

↳ Decision making in target firing

kissi 1 main pass

$$P(A_1 \cup A_2 \cup \ldots \cup A_k) = \sum_{i=1}^{k} P(A_i) - \sum\sum P(A_i \cap A_j) + \sum\sum\sum P(A_i \cap A_j \cap A_k)$$

$$\ldots \sum\sum\sum \ldots \sum P(A_i \cap A_j \cap \ldots \cap A_k)$$

Counting Technique: (Agr 2 dices throw kro to 6 ki possibility aur agr 50 dices throw kro to 6 ki possibility (is main sample space banana boht mushkil issy liye counting technique ko hum use krty hain))

Example 2a:

$m \times n$

$n_1 \times n_2 \times n_3 \times n_4 \times \ldots \times n_k$

$10 \times 3 = 30$

- **Probablity:** kissi bhi chez k occur hoony k chances
- **Possibility:** wo chez kesy kesy occur hoo skti - Un possibilities ko total per divide to phir probablity

Example 2b:

$3 \times 4 \times 5 \times 2$

Dice throwing: (3 times)

$6 \times 6 \times 6 = 6^3$ → not actual formula

Coin tossing five times:

$2 \times 2 \times 2 \times 2 \times 2 = 2^5$

Debit Card:

Password:

$10 \times 10 \times 10 \times 10 = 10{,}000$

$0-9 = 10$

$a-z = 26$

$A-Z = 26$

Special Character = 5

Total: 67

$67 \times 67 \times 67 \times 67 \times 67 \times 67 \times 67 \times 67 = 67^8$

$$\frac{67^8}{10{,}000 \times 60 \times 60 \times 24 \times 30 \times 12} = 1305 \text{ years}$$

↳ 1 second, minutes, hours, days, months

main computer 10K loop chillata

Combination:
Class main sy 2 bando ko select krna hai

Permutation:
A & B select kiye aur pehla President aur dosra Vice President

11/04/2022

$m \times n$

$n_1 \times n_2 \times n_3 \dots \times n_n$

10×3

$2 \times 2 \times 2 = 2^3$

$6 \times 6 \times 6 \times 6 \times 6 = 6^5$

$10 \times 10 \times 10 \times 10 = 10{,}000$ $\boxed{0-9 = 10}$

Permutation

$\boxed{obj = 3}$ A B C

arrangement = 2

AB BA
AC CA
BC CB

${}^3P_2 = 6$

→ order matters

Combination

$\boxed{obj = 3}$ A B C

arrangements = 2

AB = BA
AC = CA
BC = CB

${}^3C_2 = 3$

→ order does not matter

$72 \times 72 \times 72 \times 72 \times 72 \times 72 \times 72 \times 72 = 72^8$

10 = 0-9
26 = a-z
26 = A-Z
10 = Special Characters
72

$10{,}000 \times 60 \times 60 \times 24 \times 30 \times 12$

↳ If computer can run 10k loops → $\boxed{\text{sequences}}$ in one second

= 2321.9 years

(Password changes after every 10 seconds) ⇒ Google

0300 $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^7$

1
2
3
4
5
6
7
8
9

$10^7 \times 10 = 10^8$

10^8

If hacker's PC run 10k sequences (loops) in 1 second then $\frac{10000}{10000} = 1$ sec. to crack password

$= \frac{10 \times 9 \times 8 \times 7 \times 6!}{6!}$

$= \frac{10!}{6!}$

${}^{10}P_4 = \frac{10!}{(10-4)!} = \frac{n}{(n-r)!}$

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

${}^nC_r = \frac{n!}{(n-r)!\,r!}$ → For Duplicates removal

01111
10111] → Different passwords

LICENSE PLATE:

① $F \times S \times 26 \times 10 \times 10 \times 10 \times 10$

② $F \times 26 \times 26 \times 10 \times 10 \times 10 \times 10$

③ $26 \times 26 \times 26 \times 10 \times 10 \times 10 \times 10$ A B

${}^nP_n = \frac{n!}{(n-n)!} = n!$

→ Factorial is special case of Permutation

${}^5P_5 = 5!$

Factorial:
↳ cheezain jahan per one by one decrease hoo rhi hooti hain

$5! = 5 \times 4 \times 3 \times 2 \times 1$

→ Agr bus main banda aya aur seats per bethna start

↳ Students & their seats in class

object = 5
arrangements = 5

→ Digit Arrangements

$10 \times 9 \times 8 \times 7$
object = 10
arrangement = 4

↳ Agr kuch nhi to phir arrangement ki baat hum nhi karain gay – Agr exist krta to phir 1 arrangement hoogi hy.

$2! = 2 \times 1$

→ Factorial of -ve number is not possible

0!: Arrangement can't be zero. There must be one arrangement itself

Deck of cards:
$\frac{1}{52}$ then $\frac{1}{51}$ then $\frac{1}{50}$

$\boxed{n_1 \times n_2 \times \dots n_2}$ → not included

Ross-8th Edition

$$^{10}C_3 = \frac{10!}{3!(10-3)!} = \frac{10\times9\times8\times\dots\times3\times2\times1}{(3\times2\times1)(7\times6\times5\times4\times3\times2\times1)} = 120$$

sirf upar waly number what kr divide

$$\frac{10\times9\times8}{3\times2\times1} = 120$$

Example 3b

$6! \times 4!$

(6) Q#5

(a) $2\times2\times2\times2\times2 = 2^5 = 32$

(b) (1,1,0,0,0)
(1,1,1,1,1)
~~(1,0,0,0,1)~~
(0,0,0,0,0)
(0,0,0,0,1)
(0,0,0,1,0)
(0,0,0,1,1)
(0,0,0,0,0)
(0,0,1,0,1)
(0,0,1,1,0)
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1,1,
1,1,
1,1,
1,1,
1,1,
1,1,

A+B+C

A: $1\times1\times2\times2\times2 = 2^3$

B: $2\times2\times1\times1\times2 = 2^3$

C: $1\times2\times1\times2\times1 = 2^2$

$= A+B+C-AB-AC-BC+ABC$

$= 16$

Ch# 02

Q# 6 → 14

3^{15}

⇒ Discrete & continuous random variable and their probability Distribution

13/04/2022

$26 \times 26 \times 26 \times 10 \times 10 \times 10 \times 10$

$26 \times 25 \times 24 \times 10 \times 9 \times 8 \times 7$

$^{26}P_3 \times {}^{10}P_4$

$\frac{n!}{n!n!...n!}$ ⇒ not included in paper

→ jahan per possibilities reduce hoo rhi wahan per permutation & combination

Q#06

$\underline{2} \times \underline{3} = 6$

04 14
09 19
08 18 $= 2$

(c) $1 \times 3 = 3$

$B^c \cup A: = 5$

Q#07

(a) $6 \times 6 \times 6 \times \ldots \times 6 = 6^{15}$ → Repitition → Person

↓ Event

7(b)

$6^{15} - 3^{15} =$

Q#08

(a) $P(A) = .3$

$P(B) = .5$

$P(A \cup B) = P(A) + P(B)$

(b) $P(A \cap \overline{B}) = P(A)$ ⇒ not common

(c) 0

Q#09

A: American

V: Visa

$P(A) = 0.24$

$P(V) = 0.61$

$P(A \cap V) = 0.11$

$P(A \cup V) = P(A) + P(V) - P(A \cap V)$

Q#10

R: Ring

N: Necklace

$P(\overline{R \cup N}) = 0.6$

$P(R) = 0.2$

$P(N) = 0.3$

$P(R \cup N) = 1 - P(\overline{R \cup N})$

$P(R \cup N) = 0.4$

$P(R \cap N) = ?$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(R \cap N) = 0.1$

Check Dependency & Independency:

$P(R \cap N) = P(R) \cdot P(N)$

$0.1 \neq 0.2 \times 0.3$

$P(\overline{F \cup G \cup S})$

$= 1 - (P(F \cup G \cup S))$

Conditional Probablity:

$P(A \mid B)$

$P(A|B) = \frac{P(A \cap B)}{P(B)}$ →

$P(B|A) = \frac{P(A \cap B)}{P(A)}$

If A&B are independent

$P(A|B) = \frac{P(A) \cdot \cancel{P(B)}}{\cancel{P(B)}} = P(A)$

$\boxed{P(B|A) = P(B)}$

$P(A \cap B) = P(A) \cdot P(B)$

If A & B are dependent:

$P(A/B) = \frac{P(A \cap B)}{P(B)}$ → $P(A \cap B) = P(A/B) \cdot P(B)$

$P(B/A) = \frac{P(A \cap B)}{P(A)}$ → $P(A \cap B) = P(B/A) \cdot P(A)$

18/07/2022

Atleast 2:

2, 3, 4, ...

Atmost 30:

..., 28, 29, 30

More upto dated

Posterior Probablity

$P(Pw) = 0.90$

$P(Pw \mid India) = 0.6$

$P(Pw \mid Zimbabwe) = 0.99$.

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

↳ Agr badal Garjay to barish ki probablity

↳ Normalization constant

→ Probablity of A such that B has occured

Information from data
current information

$$P(A \mid B) = \frac{P(B \mid A) \cdot P(A)}{P(B)}$$

→ prior info

normalization constant

$$P(B \mid A) = \frac{P(A \mid B) \cdot P(B)}{P(A)}$$

India k khilaf match khela ho aur match jeeta hoo.

Pakistan k aam toor per jeetn k chances

$$P(B/A) = \frac{P(A \cap B)}{P(A)}$$

Independent:

Naive Bays Classifier

$P(A \cap B) = P(A) \cdot P(B)$

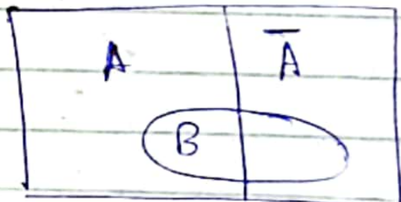
$P(A/B) = P(A)$

$P(B \mid A) = P(B)$

↳ Given that sign

$P(Pw)$ 1st Over)

⋮



If events are Dependent:

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)} \longrightarrow P(A \cap B) = P(A \mid B) \cdot P(B) \rightarrow \text{I}$$

$$P(B \mid A) = \frac{P(B \cap A)}{P(A)} \longrightarrow P(A \cap B) = P(B \mid A) \cdot P(A) \rightarrow \text{II}$$

$B = (A \cap B) \cup (\bar{A} \cap B)$

Total Probablity Theorem

$P(B) = P(A \cap B) + P(\bar{A} \cap B)$

Prob marks
Except Prob total marks

$$P(A \mid B) \cdot P(B) = P(B \mid A) \cdot P(A)$$

$$P(A \mid B) = \frac{P(B \mid A) \cdot P(A)}{P(B)} \Rightarrow \text{Bays Theorem}$$

$$P(A \mid B) = \frac{P(B \mid A) \cdot P(A)}{P(A \cap B) + P(\bar{A} \cap B)}$$

Bays Theorem with Total Probablity

$$P(A \mid B) = \frac{P(B \mid A) \cdot P(A)}{P(B \mid A) \cdot P(A) + P(B \mid \bar{A}) \cdot P(\bar{A})}$$

Example:

Machine Learing (Words Prediction)

This is
was

$P(was \mid This)$

$P(is \mid This)$

$$P(A \cap B) = P(B \mid A) \cdot P(A) = P(A \mid B) \cdot P(B)$$

$$P(B \mid A) = \frac{P(A \mid B) \cdot P(B)}{P(A \mid B) \cdot P(B) + P(A \mid \bar{B}) \cdot P(\bar{B})}$$

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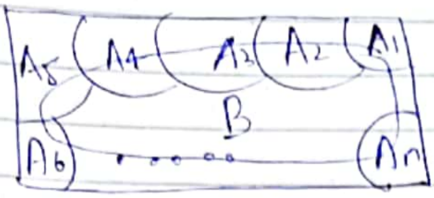


$$P(B) = P(A_1 \cap B) + \cdots + P(A_n \cap B)$$

$$P(B) = P(B|A_1)\cdot P(A_1) + P(B|A_2)\cdot P(A_2) + \cdots + P(B|A_n)\cdot P(A_n)$$

$$= \sum_{i=1}^{n} P(B|A_i)\cdot P(A_i)$$

$$P(A_i|B) = \frac{P(B|A_i)\cdot P(A_i)}{\sum_{i=1}^{n} P(B|A_i)\cdot P(A_i)}$$

Example 2e:

F: French

C: Chemistry

A: A grade

$P(A|C) = \frac{2}{3}$

$P(A|F) = \frac{1}{2}$

$P(C) = \frac{1}{2}$

$P(F) = \frac{1}{2}$

~~$P(A \cap C) =$~~

$$P(A \cap C) = P(A|C)\cdot P(C) = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$$

$$P(A \cap F) = P(A|F)\cdot P(F) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Example 3a (Part I)

↳ HomeWork

Example 2a:

less than x hours $= L_x$

Full hours $= F$

$$P(L_x) = \frac{x}{2}$$

$$P(L_{0.75}) = \frac{0.75}{2}$$

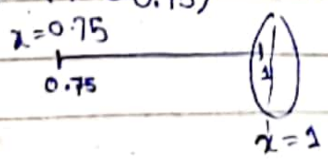
$$P(F|\overline{L_{0.75}}) = \frac{P(F \cap \overline{L_{0.75}})}{P(\overline{L_{0.75}})} = \frac{1/2}{0.625} = 0.8$$

$$P(\overline{L_{0.75}}) = 1 - P(L_{0.75})$$

$$= 1 - \frac{0.75}{2}$$

$$= 0.625$$

$$P(F \cap \overline{L_{0.75}}) = P(F)$$



$$P(F) = P(\overline{L_1})$$

$$= 1 - 1/2 = 1/2$$

20/04/2022

Example:3a (T):

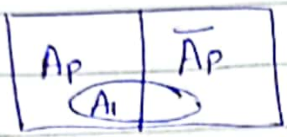
A_p: Accidental Prone

A_1: Accident in 1 year

$P(A_1|A_p) = 0.4$

$P(A_1|\overline{A_p}) = 0.2$

$P(A_p) = 0.3 \Rightarrow P(\overline{A_p}) = 0.7$



$(A_1 \cap A_p) + (A_1 \cap \overline{A_p})$

→ Total Probablity Theorem

$P(A_1) = P(A_1|A_p) \cdot P(A_p) + P(A_1|\overline{A_p}) P(\overline{A_p})$

$P(A_1) = (0.4)(0.3) + (0.2)(0.7)$

$P(A_1) = 0.26$

Part II:

$$P(A_p|A_1) = \frac{P(A_1|A_p) \cdot P(A_p)}{P(A_1)}$$

$$= \frac{(0.4)(0.3)}{(0.26)}$$

$$= 0.46$$

Example:3c:

K: knowing

C: correctly

$P(K) = 0.7$

$P(\overline{K}) = 0.3$

$P(C|\overline{K}) = \frac{1}{m} = \frac{1}{4}$

$$P(K|C) = \frac{P(C|K) \cdot P(K)}{P(C|K) \cdot P(K) + P(C|\overline{K}) \cdot P(\overline{K})}$$

$$= \frac{1 \times 0.7}{(1 \times 0.7)(\frac{1}{4} \times 0.3)}$$

Examples: 3d:

Y : Has Disease

N : Don't have disease

$+$:

$-$:

$$P(+|Y) = 0.95 \Rightarrow P(-|Y) = 0.05$$

$$P(+|N) = 0.01 \Rightarrow P(-|N) = 0.99$$

$$P(Y) = 0.005$$

$$P(Y|+) = \frac{P(+|Y) \cdot P(Y)}{P(+|Y) \cdot P(Y) + P(+|N) \cdot P(N)}$$

$$= (0.95)(0.$$

$$= 0.32$$