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Question-1

Total no of students : 12

sort the number

12

13

15

16

17

18

19

20

21

22

25

28

mean

18.83

number
- mean

-6.83

-5.83

-3.83

-2.83

-1.83

-0.83

0.17

1.17

2.17

3.17

1.17

9.17

 $(x_1 - x_2)^2$

46.64

33.98

14.11

8.00

3.37

0.47

0.028

1.3189

4.7089

10.04

38.01

84.08

245.6118

Sum of All numbers :

226

a.) i.) compute mean

$$\text{mean} = \frac{\text{sum of all values}}{\text{no of values}}$$

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

$$\text{Mean} = \frac{226}{12} = \underline{18.83}$$

a.) ii.) median

$$= \frac{x_{n/2} + x_{n/2 + 1}}{2} = \frac{18 + 19}{2} = \underline{18.50}$$

= 18.50 //

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$$\text{Range} = \text{maximum} - \text{minimum}$$

$$= 28 - 12 = \underline{16}$$

$$\text{Sample Variance } s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}$$

Refer to Page 1
for calculation

$$= \frac{245.6668}{12-1}$$

$$= \underline{22.33345}$$

$$\text{IQR} = Q_3 - Q_1$$

 Q_3 is the third quartile Q_1 is the first quartile

$$Q_3 = \text{upper half of median} = \frac{21+22}{2} = \underline{21.5}$$

$$Q_1 = \text{lower half of median} = \frac{15+16}{2} = \underline{15.5}$$

$$\text{IQR} = 21.5 - 15.5 = \underline{6}$$

$$\text{lower fence} = Q_1 - (1.5 \times \text{IQR}) = 15.5 - (1.5 \times 6) = \underline{6.5}$$

$$\text{upper fence} = Q_3 + (1.5 \times \text{IQR}) = 21.5 + (1.5 \times 6) = \underline{30.5}$$

b.) Outliers =

The data value is (12 - 28), all are within lower fence (6.5) and upper fence (30.5), hence the data set has no outliers.

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Question-2

Subjects	Probability of Passing (P)	Probability of Failing $P' = 1 - P$
A	$P(A) = \frac{4}{5}$	$P(A') = \frac{1}{5}$
B	$P(B) = \frac{3}{4}$	$P(B') = \frac{1}{4}$
C	$P(C) = \frac{5}{6}$	$P(C') = \frac{1}{6}$
D	$P(D) = \frac{2}{3}$	$P(D') = \frac{1}{3}$

probability of Qualifies : must Pass A and atleast 2 other subjects

^{Pass in all 4}
 (A, B, C, D) ^{Fail D} (A, B, \cancel{C}) ^{Fail B} (A, \cancel{C}, D) ^{Fail C} (A, B, \cancel{D})

$$P(Q) = P(A) \times P(\text{at least } B, C, D)$$

Scenario 1 Passes 3 subjects (B, C, D)

$$= P(B) \times P(C) \times P(D)$$

$$= \frac{3}{4} \times \frac{5}{6} \times \frac{2}{3}$$

$$= \frac{30}{72} = \frac{5}{12} //$$

Scenario 2

Passes 2 subject and 1 fails

$$\text{Pass B, C, Fail D} = P(B) \times P(C) \times P(D') = \frac{3}{4} \times \frac{5}{6} \times \frac{1}{3} = \frac{1}{4}$$

$$\text{Pass B, D, Fail C} = P(B) \times P(D) \times P(C') = \frac{3}{4} \times \frac{2}{3} \times \frac{1}{6} = \frac{1}{12}$$

$$\text{Pass C, D, Fail B} = P(C) \times P(D) \times P(B') = \frac{5}{6} \times \frac{2}{3} \times \frac{1}{4} = \frac{5}{36}$$

$$= \frac{15}{72} + \frac{6}{72} + \frac{10}{72} = \frac{31}{72} //$$

(A)

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$P(\text{at least } B, C, D)$

probability of getting 2 = pass all B, C, D + either one B, C, D fails

$$= \frac{5}{12} + \frac{31}{72}$$

$$= \frac{61}{72}$$

Final quantity $P(\text{qualifies}) = P(A) \times P(\text{at least } B, C, D)$

$$= \frac{4}{5} \times \frac{61}{72}$$

$$= \frac{244}{360}$$

$$\frac{244}{360}$$

$$= \frac{122}{180}$$

$$= \frac{61}{90}$$

probability of student
qualifies. $= \frac{61}{90}$

Question-3

5.

Email	sender	contains link	Spam
1	friend	NO	NO
2	un known	yes	yes
3	friend	yes	NO
4	unknown	NO	NO
5	unknown	yes	yes

Total event - 5

Spam yes - 2 = Probability of yes = $\frac{2}{5} = 0.4$

Spam NO - 3 = Probability of NO = $\frac{3}{5} = 0.6$

~~Apply Laplace Smoothing (K=1 two possible classes)~~

~~Probability of spam yes = $\frac{2+1}{5+2} = \frac{3}{7}$~~

~~Probability of spam NO = $\frac{3+1}{5+2} = \frac{4}{7}$~~

conditional probabilities (with Laplace smoothing)

$$P(x=x | C=c) = \frac{\text{count} + 1}{\text{total class} + K}$$

K = 2 because each feature has 2 categories
(friend/unknown) (yes/no)

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Spam Yes

Email (1, 5)

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Spam class (count = 2) (spam yes)

Sender unknown

$$P(\text{unknown} | \text{spam}) = \frac{2+1}{2+2} = \frac{3}{4} = 0.75$$

contains link No given spam

spam = Yes, link = No = 0

Spam NO

$$P(\text{NO link} | \text{spam}) = \frac{0+1}{2+2} = \frac{1}{4} = 0.25$$

Email (1, 3, 1) count = 3

Sender = unknown given Not-spam

unknown sender = 1

contains link YES = 1

contains link NO = 2

$$P(\text{unknown} | \text{NOT SPAM}) = \frac{1+1}{3+2} = \frac{2}{5} = 0.4$$

contains link = NO given not-spam

$$P(\text{NO link} | \text{NOT SPAM}) = \frac{2+1}{3+2} = \frac{3}{5} = 0.6$$

naive Bayes posterior scores

Score for SPAM			Not SPAM		
0.6	0.75	0.25	0.6	0.4	0.6

$$0.6 \times 0.75 \times 0.25$$

$$0.075$$

$$0.6 \times 0.4 \times 0.144$$

$$0.144$$

$$0.144 > 0.075$$

Email is Not spam

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Name : surresh babu V

Question ④

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capacitance(μF)	Box#			
	1	2	3	
0.1	35	25	40	100
0.5	75	95	70	240
1.0	60	10	65	135
Total	170	130	175	475

Baye's Theorem

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

$P(A)$ - prior probability or

$P(B)$ - total probability of B
(overall possible event)

$P(A|B)$ - probability of event A
happening given B occurs

$P(B|A)$ - Probability of B
occurring if A happens

Total probability $P(B) = \sum_i P(B|A_i)P(A_i)$

i.) Capacitor 0.1 μF is selected, what is probability it came from Box 3.

condition probability of box(3) for 0.1 $\mu F = \frac{40}{175}$

Total probability

$$= \frac{1}{3} \left(\frac{35}{170} + \frac{25}{130} + \frac{40}{175} \right)$$

$$= \frac{1}{3} (0.20588 + 0.19231 + 0.22857)$$

$$= 0.20892$$

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$$\text{probability of box 3} = \frac{40}{173} \times \frac{1}{3}$$

$$= 0.0761828$$

$$= \frac{0.07619}{0.20892}$$

$$= 0.365$$

Answer 1

$$= \underline{\underline{36.5\%}}$$

ii.) if box 2 is selected, what is the probability that it has a capacitor of 0.5 μF ?

$$= \frac{95}{130}$$

$$= 0.7308$$

$$\text{Answer} = \underline{\underline{73\%}}$$