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Summer-20 Final Term Assignment

Subject: Probability and Statistics

Note: Please attempt all Questions in sequence. All questions carry equal marks. **(50)**

Q1: Construct a grouped distribution table for the following data and Calculate Mean, Mode Median and Quartiles.

423, 369, 387, 411, 393, 394, 371, 377, 389, 409, 392, 408, 431, 401, 363, 391, 405, 382, 400, 381, 399, 415, 428, 422, 396, 372, 410, 419, 386, 390

Class	Frequency	Midpoint	C.F	$\bar{X}=\sum fx$	C.B
360-374	4	367	4	1468	359.5-374.5
375-389	6	382	10	2292	374.5-389.5
890-404	9	397	19	3573	389.5-404.5
405-419	7	412	26	2884	404.5-419.5
420-434	4	427	30	1708	419.5-434.5
	n=30			11925	

Mean $= \frac{\sum fx}{\sum f}$

$= \frac{11925}{30}$

$=397.5$

Median$= \left(L + \frac{n/2 - cf}{\;} \right) h \longrightarrow$ 1

F

To find median class

= value of $(n/2)^{th}$

= 30/2 => 15

From the column of cumulative frequency Cf, we find that the 15^{th} observant lies in class 390-404

The median class is 389.5-404.5 put it in eq 1.

m=C + n/2-c.f h

f

where L=389.5

n=30

cf=10

f=9

ob=15

$$m=389.5+\left(\frac{15-10}{9}\right).15$$

m=389.5+ (5/9) 15

m=389.5+8.33

m= 397.83

To find Mode

Here maximum frequency is 9 so the mode class is 389.5-404.5

$$\text{Mode}: \left(\frac{L+ f_1 - f_o}{2.f_2-f_o-f_2}\right).C$$

Where L= 389.5

f1=9

fo =6

f2 =7

C=15

$$=389.5+\left(\frac{9-6}{2.9-6-7}\right).15$$

=389.5+ (3/5). 15

=389.5+9

=389.5

To Find Quartile:

Q3 = (3n/4) = (3+30/4) => 22.5

Which lies under 404.5-419-5

Q3 class: 404.5-419.5

So $Q3 = L + \left(\frac{3n/4 - Cf}{F}\right).h$

Where L=404.5

Cf=19

h=15

f=7

$Q3 = 404.5 + \left(\frac{22.5-19}{7}\right).15$

$= 404.5 + \left(\frac{3.5}{7}\right).15$

=404.5+7.5

412

Q2: By multiplying each of the numbers 3,6,2,1,7,5 by 2 and then adding 5, we obtain 11,17,9,7,19,15. What is the relation between the standard deviation and the means of the two sets.

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QNo 2 Answer.

Set A

3, 6, 2, 1, 7, 5

Mean = $\frac{3, 6, 2, 1, 7, 5}{6}$

$= \frac{424}{6}$

$= 4$

Set B

11, 17, 9, 7, 19, 15

mean = $\frac{11, 17, 9, 7, 19, 15}{6}$

$\frac{78}{6}$

$= 13$

Set A:

$SD = \frac{3+6+2+1+7+5}{6}$

$= 4$

$= (3-4)^2 + (6-4)^2 + (2-4)^2 + (1-4)^2 + (7-4)^2 + (5-4)^2$

$= 1+4+4+9+9+1$

$= 28 \Rightarrow \sqrt{28} \Rightarrow 5.29$

Set B

$S.D = (11-13)^2 + (17-13)^2 + (9-13)^2 + (7-13)^2 + (19-13)^2 + (15-13)^2$

$= 4+16+16+36+36+4$

$= 112 \Rightarrow \sqrt{112}$

$= 16.58$ so, it is clean that standard deviation of set B is double

Prime Notes

Q3: For the following grouped distribution table Calculate the Variance and Standard Deviation

Class	64-84	85-104	105-124	125-144	145-164	165-184	185-204
Frequency	15	18	27	10	6	5	13

Class	Frequency	CF	X	$\overline{X}$=fx	X^2	Fx^2
64-84	15	15	74	110	5476	82140
85-104	18	33	94.5	170	893025	160744.5
105-124	27	60	114.5	3091.5	13110.25	353976.75

125-144	10	70	134.5	1345	18690.25	186402.5
145-164	6	76	154.5	927	23870.25	143221.5
165-184	5	81	174.5	872.5	30450.25	152251.25
185-204	13	94	194.5	2528.5	37830.25	491793.25
	94			11575.5	138357.5	1571029.75

$$\left(\frac{1571029.75}{94}\right)-\left(\frac{11575.5}{94}\right)^2$$

=16713.082 -15169.35

S^2=1548.73

Standard Deviation: √1528.73

=39.35

Q4: If two fair dice are thrown, what is the probability of getting

1. A double six
2. A sum of 8 or more dots

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2. A sum of 8 or more dots

Sol:

The sample space S is represented by the following 36 outcomes

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)}

1. Let A be the event that double six occurs

A= {(6,6)} and thus

P(A) =1/36

2. Let B denotes that a sum of 8 or more dots occurs

B= {(2,6), (3,5), (3,6), (4,4), (4,5), (4,6), (5,3), (5,4), (5,5), (5,6), (6,2), (6,3), (6,4), (6,5), (6,6)}

Hence

P(B) = 15/36 = 5/12

Q5. Let C1,C2,⋯,CMC1,C2,⋯,CM be a partition of the sample space SS, and AA and BB be two events. Suppose we know that

- A and B are conditionally independent given **C_i**, for all i ∈{1,2,⋯,M}
- B is independent of all **C_i's.**

Prove that A and B are independent.

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QNo 5

Answer

Since the C_i, S form partition of the sample space, we can apply the law of latel probability for

$A \cap B$

$$P(A \cap B) : \sum_{i=1}^{M} P(A \cap B / C_i) P(C_i)$$

$$\sum_{i=1}^{M} P(A / C_i) P(B / C) P(C_i)$$

$$\sum_{i=1}^{M} P(A / C_i) P(B) P(C_i)$$

$$P(B) \sum_{i=1}^{M} P(A / C_i) P(C_i)$$

$$P(B) \; P(A)$$ Answer

Prime Notes

Good Luck