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REG NO :

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FINAL PAPER :

PROBABILITY AND STATISTIC.

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Question # 01

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

423, . . . . . . . . . . ., 390

Solution

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

max value = 431

min value = 363

Large = 431 - 363

= 68

Since large is 68 we will choose an interval length of 10

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| Class Interval | Frequency | midpoint | F.m | cf |
|---|---|---|---|---|
| 360-369 | 2 | 364.5 | 729 | 2 |
| 370-379 | 3 | 374.5 | 1123.5 | 5 |
| 380-389 | 5 | 384.5 | 1922.5 | 10 |
| $\boxed{390-399}$ | 7 | 394.5 | 2761.5 | 17 |
| 400-409 | 5 | 404.5 | 2022.5 | 22 |
| 410-419 | 4 | 414.5 | 1658 | 26 |
| 420-429 | 3 | 424.5 | 1273.5 | 29 |
| 430-439 | 1 | 434.5 | 434.5 | 30 |
| | 30 | | 11925 | |

$$mean = \frac{\Sigma f \cdot m}{\Sigma f}$$

$$= \frac{11925}{30}$$

$$\boxed{mean = 397.5}$$

$$medium = lm + \left(\frac{\frac{\Sigma f}{2} - cf_{cb}}{fm}\right) c$$

$$= 3895 + \left(\frac{\frac{30}{2} - 10}{7}\right)(399.5 - 389.5)$$

$$= 389.5 + \left(\frac{15 - 10}{7}\right) 10$$

$$= 389.5 + \left(\frac{5}{7}\right) 10$$

$$= 389.5 + \frac{50}{70}$$

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$= 389.5 + 7.1428$

$\boxed{\text{mediam} = 396.6}$

$\text{mode} = l_m + \left(\frac{\Delta_1}{\Delta_1 + \Delta_2}\right) c$

$= 389.5 + \left(\frac{2}{2+2}\right) 10$

$= 389.5 + \cancel{[illegible]} \left(\frac{\cancel{2}}{\cancel{4}2}\right) 10$

$= 389.5 + \frac{\cancel{10}5}{\cancel{2}}$

$= 389.5 + 5$

$\boxed{\text{mode} = 394.5}$

$l_m = 389.5$

$\Delta_1 = 7 - 5 = 2$

$\Delta_2 = 7 - 5 = 2$

$c = 399.5 - 389.5 = 10$

## Quartile

| class Interval | frequncy | c.f |
|---|---|---|
| 360-369 | 2 | 2 |
| 370-379 | 3 | 5 |
| 380-389 | 5 | $\boxed{10}$ |
| $\boxed{390-399}$ | $\boxed{7}$ | 17 |
| 400-409 | 5 | 22 |
| 410-419 | 4 | 2 |
| 420-429 | 3 | 28 |
| 430-439 | 1 | 29 |
| | 30 | 30 |

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$$Q = D = \frac{Q_3 - Q_1}{2}$$

$$Q_1 = l + \frac{h}{f}(\Sigma_1 - c) \qquad \Sigma_1 = \frac{n}{4} = \frac{30}{4} = 7.5$$

$l = 390 \quad f = 7 \quad h = 4 \quad c = 10$

$$= 390 + \frac{4}{7}(7.5 - 10).$$

$$= 390 + 0.5(-2.5)$$

$$= 390 - 2$$

Quartile $= 388$

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Question #02

By multiplying each of the number 3,6,2,1,7,5 by 2 . . . . . . . . . . . . . two sets.

| X | $X_i - 4$ | $(X_i - U)^2$ |
|---|---|---|
| 7 | -6 | 36 |
| 9 | -4 | 16 |
| 11 | -2 | 4 |
| 17 | 4 | 16 |
| 15 | 2 | 4 |
| 19 | 6 | 36 |
| $\Sigma X = 78$ | $\Sigma(X_1 - U) = 0$ | $\Sigma(X_i - U)^2 - 112$ |

$$\text{mean} = \frac{\Sigma X}{N}$$

$$= \frac{78}{6}$$

$$= 13$$

$$S \cdot D = \sigma = \sqrt{\frac{\Sigma(X_1 - U)^2}{N}} = \sigma = \sqrt{\frac{112}{13}}$$

The mean is a measure of control lendenay the standard deviation is a measure of dispersion. Both one appropriate desciptive statistics for normally distributed data sets using ratio or interval

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Scaling. Both mean and standard deviation are used in calculating some correlation coefficients, effect sizes. t scores, F scores (Analysis of Variance)

Question #03

| Class | Frequency | Class-boundries | x | $x^2$ |
|---|---|---|---|---|
| 64-84 | 15 | 63.5 - 84.5 | 74 | 5476 |
| 85-104 | 18 | 84.5 - 104.5 | 94.5 | 8930.25 |
| 105-124 | 27 | 104.5 - 124.5 | 114.5 | 13110.25 |
| 125-144 | 10 | 124.5 - 144.5 | 134.5 | 18090.25 |
| 145-164 | 6 | 144.5 - 164.5 | 154.5 | 23870.25 |
| 165-184 | 5 | 164.5 - 184.5 | 174.5 | 30450.25 |
| 185-204 | 13 | 184.5 - 204.5 | 194.5 | 37830.25 |
| | = 94 | | | |

| $fx$ | $fx^2$ |
|---|---|
| 1110 | 82140 |
| 1701 | 160744.5 |
| 3091.5 | 353,976.75 |
| 1345 | 180902.5 |
| 927 | 143221.5 |
| 872.5 | 152251.25 |
| 2528.5 | 491,793.25 |
| = 11575.5 | 1565029.75 |

**Standard deviation:-**

$$S = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

$$= \sqrt{\frac{1565029.75}{94} - \left(\frac{11575.5}{94}\right)^2}$$

$$= \sqrt{16649.25 - (123.14)^2}$$

$$= \sqrt{16649.25 - 15163.46}$$

$$= \sqrt{1485.79}$$

$S = 2207.571 .92$

Variance:-

$$s^2 = (\sqrt{s})^2$$

$$s^2 = 1485.79$$

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# Question # 04

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

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

## Solution

The sample space S is represented by the following 36 outcomes

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

1. Let A be the event that double six occurs and thus

$A = \{(6,6)\}$

$P(A) = 1/36$

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 $C_1, C_2, \dots, C_M$ be a partition of the sample space $S$, and $A$ and $B$ be two events. Suppose we know that.

- $A$ and $B$ are conditionally independent given $C_i$, for all $i \in \{1, 2, \dots, M\}$;
- $B$ is independent of all $C_i$'s.

Prove that $A$ and $B$ are independent.

Solution:

Since the $C_i$'s form a partition of the sample space, we can apply the law of total probability for $A \cap B$:

$$
\begin{aligned}
P(A \cap B) &= \sum_{i=1}^{m} P(A \cap B \mid C_i)\, P(C_i) \\
&= \sum_{i=1}^{m} P(A \mid C_i)\, P(B \mid C_i)\, P(C_i) \quad \text{(A \& B are conditionally independent)} \\
&= \sum_{i=1}^{M} P(A \mid C_i)\, P(B)\, P(C_i) \quad \text{(B is independent of all } C_i\text{'s)} \\
&= \sum_{i=1}^{m} P(B) \sum_{i=1}^{m} P(A \mid C_i)\, P(C_i) \\
&= P(B)\, P(A) \quad \text{(law of total probability)}
\end{aligned}
$$