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Solution

MSE Examination 2019-20

Max. Marks: 20 Class: FYMCA
Semester: II Subject: **Probability and Statistics**

Q. 1 a) We prepare the following table.

C.I	Frequency f_i	Cumulative Freqency
30-35	5	5
35-40	10	15
40-45	30	45
45-50	35	80
50-55	15	95
55-60	5	100
Σ	100	

$N=\Sigma f_i=100$

For the first quartile Q_1 $\quad \frac{N}{4}=25$

Q_1 class $(l_1-l_2)=(40\text{-}45)$
Frequency of the Q_1 class (f)= 35
Cumulative Frequency of the just previous to Q_1 class (F)=45

$$Q_1=l_1+\frac{(l_2-l_1)}{f}\left(\frac{N}{4}-F\right)=40+\frac{(45-40)}{30}(25-15)=41.6667$$

For the second quartile Q_2 =Median $\quad \frac{N}{2}=50$

Median class $((l_1-l_2)=(45\text{-}50)$
Frequency of the median class (f)= 35
Cumulative Frequency of the just previous to median class (F)=45

$$\text{Median } Q_2=l_1+\frac{(l_2-l_1)}{f}\left(\frac{N}{2}-F\right)=45+\frac{(50-45)}{35}(50-45)=45.7143$$

For the third quartile Q_3 $\quad \frac{3N}{4}=75$

Q_3 class $(l_1-l_2)=(45\text{-}50)$
Frequency of the Q_3 class (f)= 35
Cumulative Frequency of the just previous to Q_3 class (F)= 45

$$Q_3=l_1+\frac{(l_2-l_1)}{f}\left(\frac{3N}{4}-F\right)=45+\frac{(50-45)}{35}(75-45)=49.2857$$

$$\text{Bowley's Coefficient of skewness}=\frac{(Q_3+Q_1-2\times Median)}{(Q_3-Q_1)}=-0.06037$$

OR

Assumed mean (a)= 35, class width (c)=10

C.I	Class mark x_i	f_i	$u_i = \frac{x_i - a}{c}$	$f_i u_i$	$f_i u_i^2$
0-10	5	15	-3	-45	135
10-20	15	15	-2	-30	60
20-30	25	23	-1	-23	23
30-40	35	22	0	0	0
40-50	45	25	1	25	25
50-60	55	10	2	20	40
60-70	65	5	3	15	45
70-80	75	10	4	40	160
Σ		125		2	488

$$\text{Mean } \bar{x} = a + c \times \frac{\sum f_i u_i}{\sum f_i} = 35 + 10 \times \frac{2}{125} = 35.16$$

$$\sigma_x = c\sqrt{\frac{\Sigma(f_f u_i^2)}{N} - (\frac{\Sigma f_i u_i}{N})^2} = 10\sqrt{\frac{488}{125} - \left(\frac{2}{125}\right)^2} = 19.76$$

$$\therefore \text{Coefficient of Variation} = \frac{S.D}{Mean} \times 100\ \% = \frac{19.76}{35.16} \times 100 = 56.20\%$$

(b)

Let the missing frequency be f.
Given mode=136
$\therefore$ Modal class $(l_1 - l_2) = (135\text{-}140)$
Frequency of modal class (f) = ?
Frequency of pre-modal class (f1) = 18
Frequency of post-modal class (f2) = 12

d_1=f-f1=f-18, d_2=f-f2=f-12

$$Mode = l_1 + \left(\frac{d_1}{d_1 + d_2}\right)(l_2 - l_1)$$

We get f=20. So missing frequency = 20.

Q. 2 a) Computation for Chi-Square Test

Day	O_i	E_i	Oi-Ei	$(Oi-Ei)^2$
1	8	10	-2	4
2	8	10	-2	4
3	10	10	0	0
4	9	10	-1	1
5	12	10	2	4
6	8	10	-2	4

7	10	10	0	0
8	14	10	4	16
9	10	10	0	0
10	11	10	1	1
Total	**100**	**100**	**0**	**34**

Calculated $\chi_0^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} = 3.4$, critical $\chi^2_{0.05,9} = 16.9$.

Since the calculated value≤The critical value, the hypothesis that numbers are uniformly distributed can be accepted.

OR

Given population mean (μ) =60 kg, Sample size (n)= 100,

Sample mean ($\bar{x}$) = 58 kg, Sample s.d (s) = 4 kg

$$z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{58 - 60}{4/\sqrt{100}} = -5$$

Level of significance (α)=0.01

Critical Value Z_α=2.58

Since $|Z| \leq / Z_\alpha$, the null hypothesis is rejected.

(b) n=5

Year	X=Year-1990	y	x^2	y^2	xy
1991	1	56	1	3136	56
1992	2	68	4	4624	136
1993	3	60	9	3600	180
1994	4	51	16	2601	204
1995	5	66	25	4356	330
$\sum$	**15**	**301**	**55**	**18317**	**906**

$$\bar{x} = \frac{\sum x_i}{n} = 3, \quad \bar{y} = \frac{\sum y_i}{n} = 60.20, \quad b_{yx} = \frac{\frac{\sum x_i y_i}{n} - \frac{\sum x_i}{n} \times \frac{\sum y_i}{n}}{\frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2} = 0.30$$

Regression of y on x is

$y - \bar{y} = b_{yx}(x - \bar{x})$ Hence y-60.20=0.3(x-3)

To estimate asset in the year 1997, x=1997-1990=7

Hence y-60.20=0.3(7-3) $\therefore$ y=61.4