STATISTICS (Q 7, PAPER 2)

1999

7 (a) Four people have a meal in a restaurant. The average cost of the meal per person is IR£12.50, excluding the service charge.
What is the total bill for the four people if a 10% service charge is added?

(b) The cumulative frequency table below shows the distribution of ages of 110 people living in an estate.

Age in years	≤ 5	≤ 10	≤ 20	≤ 35	≤ 50	≤ 60
Number of people	5	15	40	90	105	110

(i) Draw the cumulative frequency curve, putting number of people on the vertical axis.

(ii) Use your curve to estimate the median age.

(iii) Use your curve to estimate the number of people who are more than 15 years of age.

(c) The number of minutes taken by 20 pupils to answer a short question is shown in the following distribution table:

Minutes	$2 - 4$	$4 - 6$	$6 - 8$	$8 - 10$
Number of pupils	6	9	4	1

By taking the data at mid-interval values, calculate
(i) the mean number of minutes taken per pupil

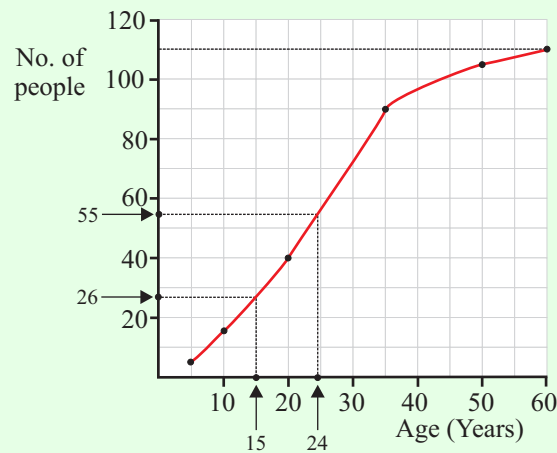(ii) the standard deviation, correct to one place of decimals.

SOLUTION

7 (a)

$$\bar{x} = \frac{x_1 + x_2 + \ldots\ldots\ldots + x_N}{N} = \frac{\text{Sum of the Numbers}}{\text{Number of Numbers}} = \frac{\sum x}{N} \quad \ldots\ldots \; \mathbf{1}$$

$$\bar{x} = \frac{\sum x}{N} \Rightarrow \sum x = N\bar{x}$$

$$\Rightarrow \sum x = 4 \times 12.50 = 50$$

The total cost of the meal for the four people is IR£50.
A 10% service charge is added. 10% of IR£50 is IR£5.
The total bill is IR£50 + IR£5 = IR£55.

7 (b) (i)

7 (b) (ii)

Half of the number of people is 55. Draw a horizontal line across to the curve and go straight down. You can read off the median age which is 24 years.

7 (b) (iii)

Go to 15 years of age on the horizontal axis. This age corresponds to 26 people. Therefore, the number of people who are more than 15 years of age = 110 – 26 = 84 people.

7 (c)

If you are asked to find the mean and standard deviation of a frequency distribution, set it out in a table as shown.

$$\bar{x} = \frac{f_1 x_1 + f_2 x_2 + \ldots + f_N x_N}{f_1 + f_2 + \ldots + f_N} = \frac{\sum fx}{\sum f} \quad \cdots \cdots \quad ②$$

$$\sigma = \sqrt{\frac{\sum fd^2}{\sum f}} \quad \cdots \cdots \quad ⑤$$

x	f	fx	d	d^2	fd^2
	$\sum f$	$\sum fx$			$\sum fd^2$

Work out the mean first. Then work out d using $d = (x - \bar{x})$. Finally, calculate the standard deviation.

x	f	fx	d	d^2	fd^2
3	6	18	– 2	4	24
5	9	45	0	0	0
7	4	28	2	4	16
9	1	9	4	16	16
	20	100			56

Draw up a table in the way as shown on the left. The mid-interval values, x, are obtained by adding the class interval values together and dividing by two.

(i) $\bar{x} = \dfrac{\sum fx}{\sum f} = \dfrac{100}{20} = 5$

(ii) $\sigma = \sqrt{\dfrac{\sum fd^2}{\sum f}} = \sqrt{\dfrac{56}{20}} = 1 \cdot 7$