Statistics

Case Study Based Questions

Case Study 1

An agency has decided to install customised playground equipments at various colony parks. For that they decided to study the age-group of children playing in a park of the particular colony. The classification of children according to their ages, playing in a park is shown in the following table:

Age group of children (in years)	Number of children
6-8	43
8-10	58
10-12	70
12-14	42
14-16	27

Based on the above information, solve the following questions:

Q1. The maximum number of children are of the age- group:

a. 12-14

b. 10-12

c. 14-16

d. 8-10

Q2. The lower limit of the modal class is:

a. 10

b. 12

c. 14

d. 8

Q3. Frequency of the class succeeding the modal class is:

a. 58

b. 70

c. 42

d. 27

Q4. The mode of the ages of children playing in the park is:

a. 9 yr

b. 8 yr

c. 11.5 yr

d. 10.6 yr

Q5. If mean and mode of the ages of children playing in the park are same, then median will be equal to:

a. Mean

b. Mode

c. Both a, and b.

d. Neither a. nor b.

Solutions

1. (b) Since, the highest frequency is 70, therefore the maximum number of children are of the age-group
10-12. Which is also called modal class.
So, option (b) is correct.

2. (a) Since, the modal class is 10-12
;- Lower limit of modal class (l) = 10
So, option (a) is correct.

3. (c) From the table, the frequency of the modal class is 70.
Thus, the frequency of the class succeeding the
modal class is 42.
So, option (c) is correct.

4. (d) Here, $l = 10$, $f_1 = 70$, $f_0 = 58$, $f_2 = 42$ and $h = 2$

$$\therefore \quad \text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 10 + \left[\frac{70 - 58}{140 - 58 - 42}\right] \times 2$$

$$= 10 + \frac{12}{40} \times 2 = 10 + \frac{24}{40} = 10.6 \text{ yr}$$

So, option (d) is correct.

5. (c) Given that, Mean = Mode

:- By Empirical relation, we have

Mode 3 Median - 2 Mean

= Mode = 3 Median - 2 Mode

= 3 Mode = 3 Median

= Median = Mode Mean

So, option (c) is correct.

Case Study 2

A petrol pump owner wants to analyse the daily need of diesel at the pump. For this he collected the data of vehicles visited in 1 h. The following frequency distribution table shows the classification of the number of vehicles and quantity of diesel filled in them:

Diesel Filled (in Litres)	3-5	5-7	7-9	9-11	11-13
Number of vehicles	5	10	10	7	8

Based on the above information, solve the following questions:

Q1. Which of the following is correct?

a. If x,and fiare sufficiently small, then direct method is appropriate choice for calculating mean.

b. If x,and fjare sufficiently large, then direct method is appropriate choice for calculating mean.

c. If x, and f, are sufficiently small, then assumed mean method is appropriate choice for calculating mean.
d. None of the above

Q2. Average diesel required for a vehicle is:

a. 8.15 L
b. 6 L
c. 7L
d. 5.5 L

Q3. If approximately 2000 vehicles comes daily at the petrol pump, then how much litres of diesel the pump should have?

a. 16200 L
b. 16300 L
c. 10600 L
d. 15000 L

Q4. The sum of upper and lower limit of median class is:

a. 22
b. 10
c. 16
d. None of these

Q5. If the median of given data is 8 L, then mode will be equal to:

a. 7.5 L
b. 7.7 L
c. 5.7L
d. 8 L

Solutions

1. (a) If f, and x, are very small, then direct method is appropriate method for calculating mean.
So, option (a) is correct.

2. (a) The frequency distribution table from the given data can be drawn as:

Class	Class mark (x_i)	Frequency (f_i)	f_ix_i	cf
3-5	4	5	20	5
5-7	6	10	60	15
7-9	8	10	80	25
9-11	10	7	70	32
11-13	12	8	96	40
Total		**40**	**326**	

$$\therefore \quad \text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{326}{40} = 8.15\,\text{L}$$

So, option (a) is correct.

3. (b) If 2000 vehicles comes daily and average quantity of diesel required for a vehicle is 8.15 L, then total quantity of diesel required = 2000 × 8.15
= 16300 L
So, option (b) is correct.

4. (c) Here, $N = 40$ and $\frac{N}{2} = 20$

cf for the distribution are 5, 15, 25, 32, 40
Now, cf just greater than 20 is 25 which is
corresponding to the class interval 7-9.
So median class is 7-9.
:- Required sum of upper limit and lower limit
=7+9=16
So, option (c) is correct.

5. (b) We know, Mode = 3 Median - 2 Mean
=3(8)-2(8.15)=24-16.3 = 7.7L
So, option (b) is correct.

Case Study 3

A group of 71 people visited to a museum on a certain day. The following table shows their ages:

Age (in years)	Number of persons
Less than 10	3
Less than 20	10
Less than 30	22
Less than 40	40
Less than 50	54
Less than 60	71

Based on the above information, solve the following questions:

Q1. If true class limits have been decided by making the classes of interval 10, then find the first class interval.

Q2. Find the cumulative frequency table.

Q3. Find the frequency of class preceding the median class.

Or

If the price of a ticket for the age group 30-40 is Rs30, then find the total amount spent by this age group.

Solutions

1. The age of any person is a positive number, so the first class interval must be 0-10.

2. Cumulative frequency table:

Age (in years)	Class interval (x_i)	Frequencies (f_i)	Cumulative frequency (cf)
Less than 10	0-10	3	3
Less than 20	10-20	10 – 3 = 7	10
Less than 30	20-30	22 – 10 = 12	22
Less than 40	30-40	40 – 22 = 18	40
Less than 50	40-50	54 – 40 = 14	54
Less than 60	50-60	71 – 54 = 17	71

3. From the table, N = 71, therefore $\frac{N}{2} = 35.5$

Now, the class interval whose cumulative frequency is just greater than 35.5 is 30-40.
:- Median class= 30-40
So, the frequency of class preceding the median class is 2.

Or

Number of persons, whose age lying in 30-40 is 18.
;- Total amount spent by people of this age group
= Rs (30 x 18)=540

Case Study 4

Electric buses are becoming popular nowadays. These buses have the electricity stored in a battery. Electric buses could have a range of approximately 280 km with just one charge. Electric buses are superior to diesel buses as they reduce brake wear and also reduce pollution. Transport department of a city wants to buy some electric buses for the city. So, the department wants to know the distance travelled by existing public transport buses in a day.

The following data shows the distance travelled by 50 existing public transport buses in a day:

Daily distance travelled (in km)	Number of buses
100-120	12
120-140	14
140-160	8
160-180	6
180-200	10

Based on the above information, solve the following questions:

Q1. Write the relation between mean, median and mode.

Q2. Find the modal class of the given distribution.

Q3. Find the 'median' distance travelled by a bus.

OR

Find the 'mean (average)' distance travelled by a bus.

Solutions

1. The relation between mean, median and mode is:
Mode = 3 (median) - 2 (Mean)
Which is also called empirical formula.

2. From the given distribution, highest frequency is 14, which lies in the class interval 120-140. This class is said to be modal class.

3. The cumulative frequency table is given below:

Daily distance travelled (in km)	Class mark (x_i)	Number of buses (f_i)	Cumulative frequency (cf)	Deviation $u_i = \frac{x_i - A}{h}$	$F_i \times u_i$
100-120	110	12	12	–2	–24
120-140	130	14	26	–1	–14
140-160	150	8	34	0	0
160-180	170	6	40	1	6
180-200	190	10	50	2	20
		$\Sigma f = 50$			$\Sigma f_i u_i = -12$

Here, $N = 50$

$\therefore \frac{N}{2} = \frac{50}{2} = 25$, which lies in the cumulative.

frequency 26, whose corresponding class is in (120-140).

Thus (120-140) is a median class.

Here, l = 120, cf=12, f= 14 and h=20

$$\therefore \text{Median} = l + \left(\frac{\frac{N}{2} - cf}{f} \right) \times h$$

$$= 120 + \frac{(25-12)}{14} \times 20 = 120 + \frac{260}{14}$$

$$= 120 + 18.57 = 138.57$$

Hence the 'median' distance travelled by a bus is 138.57 km.

OR

$$\text{Now, Mean} = A + \frac{\Sigma f_i u_i}{\Sigma f} \times h$$

(by step deviation method)

Here assumed mean (A) = 150.

$$\therefore \quad \text{Mean} = 150 + \frac{(-12)}{50} \times 20$$

$$= 150 - \frac{24}{5}$$

$$= 150 - 4.8 = 145.2$$

Hence, 'mean (average)' distance travelled by a bus is 145.2 km.

Solutions for Questions 5 to 14 are Given Below

Case Study 5

Installation of Playing Equipments in Parks

An agency has decided to install customised playground equipments at various colony parks. For that they decided to study the age-group of children playing in a park of the particular colony. The classification of children according to their ages, playing in a park is shown in the following table.

Age group of children (in years)	6-8	8-10	10-12	12-14	14-16
Number of children	43	58	70	42	27

Based on the above information, answer the following questions.

(i) The maximum number of children are of the age-group

(a) 12-14 (b) 10-12 (c) 14-16 (d) 8-10

(ii) The lower limit of the modal class is

(a) 10 (b) 12 (c) 14 (d) 8

(iii) Frequency of the class succeeding the modal class is

(a) 58 (b) 70 (c) 42 (d) 27

(iv) The mode of the ages of children playing in the park is

(a) 9 years (b) 8 years (c) 11.5 years (d) 10.6 years

(v) If mean and mode of the ages of children playing in the park are same, then median will be equal to

(a) Mean (b) Mode

(c) Both (a) and (b) (d) Neither (a) nor (b)

Case Study 6

Business Expansion

As the demand for the products grew, a manufacturing company decided to hire more employees. For which they want to know the mean time required to complete the work for a worker.
The following table shows the frequency distribution of the time required for each worker to complete a work.

Time (in hours)	15-19	20-24	25-29	30-34	35-39
Number of workers	10	15	12	8	5

Based on the above information, answer the following questions.

(i) The class mark of the class 25-29 is
(a) 17 (b) 22 (c) 27 (d) 32

(ii) If x_i's denotes the class marks and f_i's denotes the corresponding frequencies for the given data, then the value of $\sum x_i f_i$ equals to
(a) 1200 (b) 1205 (c) 1260 (d) 1265

(iii) The mean time required to complete the work for a worker is
(a) 22 hrs (b) 23 hrs (c) 24 hrs (d) none of these

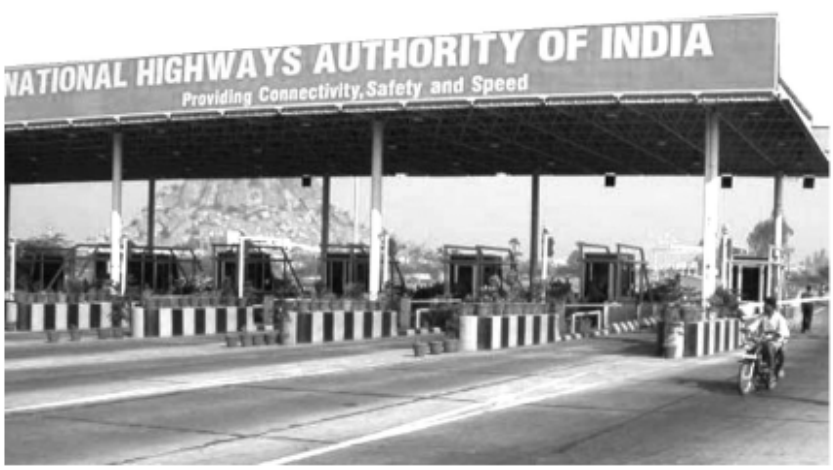
(iv) If a worker works for 8 hrs in a day, then approximate time required to complete the work for a worker is
(a) 3 days (b) 4 days (c) 5 days (d) 6 days

(v) The measure of central tendency is
(a) Mean (b) Median (c) Mode (d) All of these

Case Study 7

Toll Tax Collection

On a particular day, National Highway Authority of India (NHAI) checked the toll tax collection of a particular toll plaza in Rajasthan.



The following table shows the toll tax paid by drivers and the number of vehicles on that particular day.

Toll tax (in ₹)	30-40	40-50	50-60	60-70	70-80
Number of vehicles	80	110	120	70	40

Based on the above information, answer the following questions.

(i) If A is taken as assumed mean, then the possible value of A is

(a) 32 (b) 42 (c) 85 (d) 55

(ii) If x_i's denotes the class marks and d_i's denotes the deviation of assumed mean (A) from x_i's, then the minimum value of $|d_i|$ is

(a) –200 (b) –100 (c) 0 (d) 100

(iii) The mean of toll tax received by NHAI by assumed mean method is

(a) ₹ 52 (b) ₹ 52.14 (c) ₹ 52.50 (d) ₹ 53.50

(iv) The mean of toll tax received by NHAI by direct method is

(a) equal to the mean of toll tax received by NHAI by assumed mean method

(b) greater than the mean of toll tax received by NHAI by assumed mean method

(c) less than the mean of toll tax received by NHAI by assumed mean method

(d) none of these

(v) The average toll tax received by NHAI in a day, from that particular toll plaza, is

(a) ₹ 21000 (b) ₹ 21900 (c) ₹ 30000 (d) none of these

Case Study 8

Distance Analysis of Public Transport Buses

Transport department of a city wants to buy some Electric buses for the city. For which they wants to analyse the distance travelled by existing public transport buses in a day.

The following data shows the distance travelled by 60 existing public transport buses in a day.

Daily distance travelled (in km)	200-209	210-219	220-229	230-239	240-249
Number of buses	4	14	26	10	6

Based on the above information, answer the following questions.

(i) The upper limit of a class and lower limit of its succeeding class is differ by

(a) 9 (b) 1 (c) 10 (d) none of these

(ii) The median class is

(a) 229.5-239.5 (b) 230-239 (c) 220-229 (d) 219.5-229.5

(iii) The cumulative frequency of the class preceding the median class is

(a) 14 (b) 18 (c) 26 (d) 10

(iv) The median of the distance travelled is

(a) 222 km (b) 225 km (c) 223 km (d) none of these

(v) If the mode of the distance travelled is 223.78 km, then mean of the distance travelled by the bus is

(a) 225 km (b) 220 km (c) 230.29 km (d) 224.29 km

Case Study 9

Group Visit to Museum

A group of 71 people visited to a museum on a certain day. The following table shows their ages.

Age (in years)	Number of persons
Less than 10	3
Less than 20	10
Less than 30	22
Less than 40	40
Less than 50	54
Less than 60	71

Based on the above information, answer the following questions.

(i) If true class limits have been decided by making the classes of interval 10, then first class must be

(a) 5-15 (b) 0-10

(c) 10-20 (d) none of these

(ii) The median class for the given data will be

(a) 20-30 (b) 10-20 (c) 30-40 (d) 40-50

(iii) The cumulative frequency of class preceding the median class is

(a) 22 (b) 13 (c) 25 (d) 35

(iv) The median age of the persons visited the museum is

(a) 30 years (b) 32.5 years

(c) 34 years (d) 37.5 years

(v) If the price of a ticket for the age group 30-40 is ₹ 30, then the total amount spent by this age group is

(a) ₹ 360 (b) ₹ 420 (c) ₹ 540 (d) ₹ 340

Case Study 10

Electric Scooter Manufacturing Company

An electric scooter manufacturing company wants to declare the mileage of their electric scooters. For this, they recorded the mileage (km/charge) of 50 scooters of the same model. Details of which are given in the following table.

Mileage (km/charge)	100-120	120-140	140-160	160-180
Number of scooters	7	12	18	13

Based on the above information, answer the following questions.

(i) The average mileage is

(a) 140 km/charge (b) 150 km/charge (c) 130 km/charge (d) 144.8 km/charge

(ii) The modal value of the given data is

(a) 150 (b) 150.91 (c) 145.6 (d) 140.9

(iii) The median value of the given data is

(a) 140 (b) 146.67 (c) 130 (d) 136.6

(iv) Assumed mean method is useful in determining the

(a) Mean (b) Median (c) Mode (d) All of these

(v) The manufacturer can claim that the mileage for his scooter is

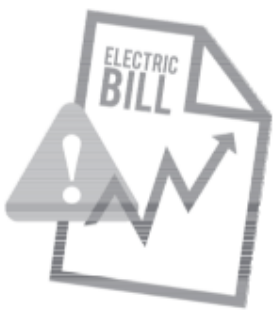
(a) 144 km/charge (b) 155 km/charge (c) 165 km/charge (d) 175 km/charge

Case Study 11

Analysis of Electricity Consumption in a Locality

An inspector in an enforcement squad of electricity department visit to a locality of 100 families and record their monthly consumption of electricity, on the basis of family members, electronic items in the house and wastage of electricity, which is summarise in the following table.

Monthly Consumption (in kwh)	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Number of families	2	5	x	12	17	20	y	9	7	4



Based on the above information, answer the following questions.

(i) The value of $x + y$ is

(a) 100 (b) 42 (c) 24 (d) 200

(ii) If the median of the above data is 525, then x is equal to

(a) 10 (b) 8

(c) 9 (d) none of these

(iii) What will be the upper limit of the modal class?

(a) 400 (b) 600

(c) 650 (d) 700

(iv) The average monthly consumption of a family of this locality is approximately

(a) 520 kwh (b) 522 kwh (c) 540 kwh (d) none of these

(v) If A be the assumed mean, then A is always

(a) > (Actual mean) (b) < (Actual Mean)

(c) = (Actual Mean) (d) can't say

Case Study 12

Corona Virus Impact on Income

Household income in India was drastically impacted due to the COVID-19 lockdown. Most of the companies decided to bring down the salaries of the employees by 50%.

The following table shows the salaries (in percent) received by 25 employees during lockdown.

Salaries received (in percent)	50-60	60-70	70-80	80-90
Number of employees	9	6	8	2

Based on the above information, answer the following questions.

(i) Total number of persons whose salary is reduced by more than 30%, is

(a) 10 (b) 20 (c) 25 (d) 15

(ii) Total number of persons whose salary is reduced by atmost 40%, is

(a) 15 (b) 10 (c) 16 (d) 8

(iii) The modal class is

(a) 50-60 (b) 60-70 (c) 70-80 (d) 80-90

(iv) The median class of the given data is

(a) 50-60 (b) 60-70 (c) 70-80 (d) 80-90

(v) The empirical relationship between mean, median and mode is

(a) 3 Median = Mode + 2 Mean (b) 3 Median = Mode – 2 Mean

(c) Median = 3 Mode – 2 Mean (d) Median = 3 Mode + 2 Mean

Case Study 13

Analysis of Validity of a Bread Packet

A bread manufacturer wants to know the lifetime of the product. For this, he tested the life time of 400 packets of bread. The following tables gives the distribution of the life time of 400 packets.

Lifetime (in hours)	Number of packets (Cumulative frequency)
150-200	14
200-250	70
250-300	130
300-350	216
350-400	290
400-450	352
450-500	400

Based on the above information, answer the following questions.

(i) If m be the class mark and b be the upper limit of a class in a continuous frequency distribution, then lower limit of the class is

(a) $2m + b$ (b) $2m+\sqrt{b}$ (c) $m - b$ (d) $2m - b$

(ii) The average lifetime of a packet is

(a) 341 hrs (b) 300 hrs (c) 340 hrs (d) 301 hrs

(iii) The median lifetime of a packet is

(a) 347 hrs (b) 340 hrs (c) 346 hrs (d) 342 hrs

(iv) If empirical formula is used, then modal lifetime of a packet is

(a) 340 hrs (b) 341 hrs (c) 348 hrs (d) 349 hrs

(v) Manufacturer should claim that the lifetime of a packet is

(a) 346 hrs (b) 341 hrs (c) 340 hrs (d) 347 hrs

Case Study 14

Diesel Requirement at a Petrol Pump

A petrol pump owner wants to analyse the daily need of diesel at the pump. For this he collected the data of vehicles visited in 1 hr. The following frequency distribution table shows the classification of the number of vehicles and quantity of diesel filled in them.

Diesel Filled (in Litres)	3-5	5-7	7-9	9-11	11-13
Number of vehicles	5	10	10	7	8

Based on the above data, answer the following questions.

(i) Which of the following is correct?

(a) If x_i and f_i are sufficiently small, then direct method is appropriate choice for calculating mean.

(b) If x_i and f_i are sufficiently large, then direct method is appropriate choice for calculating mean.

(c) If x_i and f_i are sufficiently small, then assumed mean method is appropriate choice for calculating mean.

(d) None of the above.

(ii) Average diesel required for a vehicle is

(a) 8.15 litres (b) 6 litres (c) 7 litres (d) 5.5 litres

(iii) If approximately 2000 vehicles comes daily at the petrol pump, then how much litres of diesel the pump should have?

(a) 16200 litres (b) 16300 litres (c) 10600 litres (d) 15000 litres

(iv) The sum of upper and lower limit of median class is

(a) 22 (b) 10 (c) 16 (d) none of these

(v) If the median of given data is 8 litres, then mode will be equal to

(a) 7.5 litres (b) 7.7 litres (c) 5.7 litres (d) 8 litres

HINTS & EXPLANATIONS

5. **(i) (b):** Since, the highest frequency is 70, therefore the maximum number of children are of the age-group 10-12.

(ii) (a): Since, the modal class is 10-12

$\therefore$ Lower limit of modal class = 10

(iii) (c): Here, $f_0 = 58, f_1 = 70$ and $f_2 = 42$

Thus, the frequency of the class succeeding the modal class is 42.

(iv) (d): Mode $= l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$

$= 10 + \left[\frac{70 - 58}{140 - 58 - 42}\right] \times 2$

$= 10 + \frac{12}{40} \times 2 = 10 + \frac{24}{40} = 10.6$ years

(v) (c): Given that, Mean = Mode

$\therefore$ By Empirical relation, we have

Mode = 3 Median – 2 Mean

$\Rightarrow$ Mode = 3 Median – 2 Mode

$\Rightarrow$ 3 Mode = 3 Median

$\Rightarrow$ Median = Mode = Mean

6. **(i) (c):** Class mark of class 25 – 29

$= \frac{25 + 29}{2} = \frac{54}{2} = 27$

(ii) (d) : Let us consider the following table :

Class	Class mark (x_i)	Frequency (f_i)	$x_i f_i$
15-19	17	10	170
20-24	22	15	330
25-29	27	12	324
30-34	32	8	256
35-39	37	5	185
Total		$\sum f_i = 50$	$\sum x_i f_i = 1265$

$$\therefore \quad \text{Mean } (\bar{x}) = \frac{\sum x_i f_i}{\sum f_i} = \frac{1265}{50} = 25.3$$

Thus, the mean time to complete the work for a worker = 25.3 hrs ≈ 3 days

(iii) (d) (iv) (a)

(v) (d): We know the measure of central tendency are mean, median and mode.

7. Let us consider the following table :

Class	Class marks (x_i)	$d_i = x_i - A$	Frequency (f_i)	$f_i d_i$
30-40	35	–20	80	–1600
40-50	45	–10	110	–1100
50-60	55 = A	0	120	0
60-70	65	10	70	700
70-80	75	20	40	800
Total			$\sum f_i = 420$	$\sum f_i d_i = -1200$

(i) (d): Clearly, the possible values of assumed mean (A) are 35, 45, 55, 65, 75.

(ii) (c) : The values of $|d_i|$ are 0, 10, 20
Thus, the minimum value of $|d_i|$ is 0.

(iii) (b): Required Mean = $A + \frac{\sum f_i d_i}{\sum f_i} = 55 - \frac{1200}{420}$
= ₹ 52.14

(iv) (a): Mean by direct and assumed mean method are always equal.

(v) (d): Average toll tax received by a vehicle = ₹ 52.14
Total number of vehicles = 420
∴ Average toll tax received in a day = ₹(52.14 × 420)
= ₹ 21898.80

8. (i) (b): The upper limit of a class and the lower class of its succeeding class differ by 1.

(ii) (d) : Here, class intervals are in inclusive form. So, we first convert them in exclusive form. The frequency distribution table in exclusive form is as follows :

Class interval	Frequency (f_i)	Cumulative frequency ($c.f.$)
199.5-209.5	4	4
209.5-219.5	14	18
219.5-229.5	26	44
229.5-239.5	10	54
239.5-249.5	6	60

Here, $\sum f_i$ *i.e.*, $N = 60$

$$\Rightarrow \quad \frac{N}{2} = 30$$

Now, the class interval whose cumulative frequency is just greater than 30 is 219.5 – 229.5.
∴ Median class is 219.5 – 229.5.

(iii) (b): Clearly, the cumulative frequency of the class preceding the median class is 18.

(iv) (d): Median = $l + \left[\frac{\frac{N}{2} - c.f.}{f}\right] \times h$

$$= 219.5 + \left(\frac{30-18}{26}\right) \times 10$$

$$= 219.5 + \frac{12 \times 10}{26} = 219.5 + 4.62 = 224.12$$

∴ Median of the distance travelled is 224.12 km

(v) (d): We know, Mode = 3 Median – 2 Mean

∴ Mean = $\frac{1}{2}$ (3 Median – Mode)

$= \frac{1}{2}$ (672.36 – 223.78) = 224.29 km

9. (i) (b): The age of any person is a positive number, so the first class must be 0 - 10.

(ii) (c) :
Let us consider the following table :

Age (in years)	Class interval (x_i)	Frequencies (f_i)	Cumulative frequency ($c.f.$)
Less than 10	0-10	3	3
Less than 20	10-20	10 – 3 = 7	10
Less than 30	20-30	22 – 10 = 12	22
Less than 40	30-40	40 – 22 = 18	40
Less than 50	40-50	54 – 40 = 14	54
Less than 60	50-60	71 – 54 = 17	71

Here, $N = 71$, therefore $\frac{N}{2} = 35.5$

Now, the class interval whose cumulative frequency is just greater than 35.5 is 30-40.

$\therefore$ Median class = 30-40

(iii) (a) : Clearly, the cumulative frequency of the class preceding the median class is 22.

(iv) (d): Median $= l+\left(\dfrac{\frac{N}{2}-c.f.}{f}\right)\times h$

$=30+\left(\dfrac{35.5-22}{18}\right)\times 10=30+13.5\times\dfrac{10}{18}=30+7.5=37.5$

Thus, the median age of the persons visited the museum is 37.5 years

(v) (c) : Number of persons, whose age lying in 30-40 = 18.

$\therefore$ Total amount spent by people of this group

$= ₹\ (30\times 18) = ₹\ 540$

10. Given frequency distribution table can be drawn as :

Class interval	Class mark (x_i)	Frequency (f_i)	x_if_i	c.f.
100-120	110	7	770	7
120-140	130	12	1560	19
140-160	150	18	2700	37
160-180	170	13	2210	50
Total		50	7240	

(i) (d) : Clearly, average mileage

$=\dfrac{7240}{50}=144.8$ km/charge

(ii) (b) : Since, highest frequency is 18, therefore, modal class is 140-160.

Here, $l=140, f_1=18, f_0=12, f_2=13, h=20$

$\therefore$ Mode $=140+\dfrac{18-12}{36-12-13}\times 20=140+\dfrac{6}{11}\times 20$

$=140+\dfrac{120}{11}=140+10.91=150.91$

(iii) (b) : Here, $\dfrac{N}{2}=\dfrac{50}{2}=25$ and the corresponding class whose cumulative frequency is just greater than 25 is 140-160.

Here, $l=140$, $c.f.=19$, $h=20$ and $f=18$

$\therefore$ Median $= l+\left(\dfrac{\frac{N}{2}-c.f.}{f}\right)\times h$

$=140+\dfrac{25-19}{18}\times 20=140+\dfrac{60}{9}=146.67$

(iv) (a) : Assumed mean method is useful in determining the mean.

(v) (a) : Since, Mean = 144.8, Mode = 150.91 and Median = 146.67 and minimum of which is 144 approx, therefore manufacturer can claim the mileage for his scooter 144 km/charge.

11. We have the following table :

Class interval	Frequency	Cumulative frequency
0-100	2	2
100-200	5	7
200-300	x	$7+x$
300-400	12	$19+x$
400-500	17	$36+x$
500-600	20	$56+x$
600-700	y	$56+x+y$
700-800	9	$65+x+y$
800-900	7	$72+x+y$
900-1000	4	$76+x+y$
Total	$76+x+y$	

(i) (c) : Here, it is given that total frequency = 100

$\therefore\ 76+x+y=100 \Rightarrow x+y=24$

(ii) (c) : Here, $\dfrac{N}{2}=\dfrac{100}{2}=50$

Also, median = 525

$\therefore$ Median class is 500-600.

Now, median $= l+\left(\dfrac{N/2-c.f.}{f}\right)\times h$

$\Rightarrow\ 525=500+\left(\dfrac{50-(36+x)}{20}\right)\times 100$

$\Rightarrow\ 5=50-36-x \Rightarrow x=9$

(iii) (b) : Since, maximum frequency is 20, so modal class is 500 – 600. Hence, upper limit of modal class is 600.

(iv) (b) : Since, $x+y=24 \Rightarrow y=24-9=15$

Required average consumption

$$=\frac{50\times 2+150\times 5+250\times 9+350\times 12+450\times 17+550\times 20+650\times 15+750\times 9+850\times 7+950\times 4}{100}$$

$=\dfrac{52200}{100}=522$ kwh

(v) (d)

12. (i) (d): Required number of persons = 9 + 6 = 15

(ii) (c) : Required number of persons = 6 + 8 + 2 = 16

(iii) (a) : 50-60 is the modal class as the maximum frequency is 9.

(iv) (b) : The cumulative frequency distribution table for the given data can be drawn as :

Salaries received (in percent)	Number of employees (f_i)	Cumulative frequency (*c.f.*)
50-60	9	9
60-70	6	9 + 6 = 15
70-80	8	15 + 8 = 23
80-90	2	23 + 2 = 25
Total	$\Sigma f_i = 25$	

Here, $\frac{N}{2} = \frac{25}{2} = 12.5$

The cumulative frequency just greater than 12.5 lies in the interval 60-70.

Hence, the median class is 60-70.

(v) (a) : We know, Mode = 3 Median – 2 Mean

$\therefore$ 3 Median = Mode + 2 Mean

13. (i) (d): We know that,

$$\text{Class mark} = \frac{\text{Lower limit + Upper limit}}{2}$$

$$\Rightarrow \quad m = \frac{\text{Lower limit} + b}{2} \quad \Rightarrow \text{ Lower limit} = 2m - b$$

(ii) (a) :

Lifetime (in hours)	Class mark (x_i)	f_i	$d_i = x_i - A$	$f_i d_i$
150-200	175	14	–150	–2100
200-250	225	56	–100	–5600
250-300	275	60	–50	–3000
300-350	325 = *A*	86	0	0
350-400	375	74	50	3700
400-450	425	62	100	6200
450-500	475	48	150	7200
Total		400		6400

$\therefore$ Average lifetime of a packet

$$= A + \frac{\sum f_i d_i}{\sum f_i} = 325 + \frac{6400}{400} = 341 \text{ hrs}$$

(iii) (b) : Here, $N = 400 \Rightarrow \frac{N}{2} = 200$

Also, cumulative frequency for the given distribution are 14, 70, 130, 216, 290, 352, 400

$\therefore$ *c.f.* just greater than 200 is 216, which is corresponding to the interval 300-350.

$l = 300$, $f = 86$, *c.f.* = 130, $h = 50$

$$\therefore \quad \text{Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f}\right) \times h = 300 + \left(\frac{200 - 130}{86}\right) \times 50$$

= 300 + 40.697 = 340.697 ≈ 340 hrs (approx.)

(iv) (a) : We know that Mode = 3 Median – 2 Mean

= 3(340.697) –2(341)

= 1022.091 – 682 = 340.091 ≈ 340 hrs

(v) (c) : Since, minimum of mean, median and mode is approximately 340 hrs. So, manufacturer should claim that lifetime of a packet is 340 hrs.

14. (i) (a): If f_i and x_i are very small, then direct method is appropriate method for calculating mean.

(ii) (a) : The frequency distribution table from the given data can be drawn as :

Class	Class mark (x_i)	Frequency (f_i)	$f_i x_i$
3-5	4	5	20
5-7	6	10	60
7-9	8	10	80
9-11	10	7	70
11-13	12	8	96
Total		40	326

$$\therefore \quad \text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{326}{40} = 8.15 \text{ litres}$$

(iii) (b) : If 2000 vehicles comes daily and average quantity of diesel required for a vehicle is 8.15 litres, then total quantity of diesel required = 2000 × 8.15

= 16300 litres

(iv) (c) : Here, $N = 40$ and $\frac{N}{2} = 20$

c.f. for the distribution are 5, 15, 25, 32, 40

Now, *c.f.* just greater than 20 is 25 which is corresponding to the class interval 7-9.

So median class is 7-9.

$\therefore$ Required sum of upper limit and lower limit

= 7 + 9 = 16

(v) (b) : We know, Mode = 3 Median –2 Mean

= 3(8) – 2(8.15) = 24 – 16.3 = 7.7