Examples:

1. The following are the weight of 10 students of a class. Find the arithmetic mean

| Roll No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight (kg) | 45 | 48 | 50 | 60 | 55 | 46 | 50 | 58 | 62 | 46 |

Solution:

| Roll No. | Weight (kg) (X) |
|---|---|
| 1 | 45 |
| 2 | 48 |
| 3 | 50 |
| 4 | 60 |
| 5 | 55 |
| 6 | 46 |
| 7 | 50 |
| 8 | 58 |
| 9 | 62 |
| 10 | 46 |
| | $\Sigma X = 520$ |

Direct method:

Arithmetic mean $(\bar{x}) = \frac{\Sigma X}{n} = \frac{520}{10} = 52$ kg

Short-cut method:

| Roll No. | Weight (kg) (X) | d = X – A = X - 50 |
|---|---|---|
| 1 | 45 | 45 – 50 = -5 |
| 2 | 48 | 48 – 50 = -2 |
| 3 | 50 | 0 |
| 4 | 60 | 10 |
| 5 | 55 | 5 |
| 6 | 46 | -4 |
| 7 | 50 | 0 |
| 8 | 58 | 8 |
| 9 | 62 | 12 |
| 10 | 46 | -4 |
| | $\Sigma X = 520$ | $\Sigma d = 20$ |

Arithmetic mean $(\bar{x}) = A + \frac{\Sigma d}{n} = 50 + \frac{20}{10} = 50 + 2 = 52$ kg

2. Find the arithmetic mean for the following data:

| X | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|
| f | 20 | 43 | 75 | 67 | 72 | 45 | 39 | 9 | 8 | 6 |

Solution:

Direct Method:

Arithmetic mean $(\bar{x}) = \frac{\Sigma fx}{n}$

| X | f | fx |
|---|---|---|
| 5 | 20 | 100 |
| 10 | 43 | 430 |
| 15 | 75 | 1125 |
| 20 | 67 | 1340 |
| 25 | 72 | 1800 |
| 30 | 45 | 1350 |
| 35 | 39 | 1365 |
| 40 | 9 | 360 |
| 45 | 8 | 360 |
| 50 | 6 | 300 |
| | $\Sigma f = n = 384$ | $\Sigma fx = 8530$ |

Arithmetic mean $(\bar{x}) = \frac{\Sigma fx}{n}$

$$= \frac{8530}{384} = 22.21$$

Short-cut method:

Arithmetic mean $(\bar{x}) = A + \frac{\Sigma fd}{n}$

| X | f | d = X – A(25) | fd |
|---|---|---|---|
| 5 | 20 | -20 | -400 |
| 10 | 43 | -15 | -645 |
| 15 | 75 | -10 | -750 |
| 20 | 67 | -5 | -335 |
| 25 | 72 | 0 | 0 |
| 30 | 45 | 5 | 225 |
| 35 | 39 | 10 | 390 |
| 40 | 9 | 15 | 135 |
| 45 | 8 | 20 | 160 |
| 50 | 6 | 25 | 150 |
| | $\Sigma f = n = 384$ | | $\Sigma fd = -1070$ |

Arithmetic mean $(\bar{x}) = A + \frac{\Sigma fd}{n} = 25 + \frac{-1070}{384} = 25 - 2.78 = 22.21$

3. Find the arithmetic mean from the data given below by Direct Method, Shortcut Method and Step Deviation Method

| Class interval | 15-25 | 25-35 | 35-45 | 45-55 | 55-65 | 65-75 |
|---|---|---|---|---|---|---|
| Frequency | 4 | 11 | 19 | 14 | 0 | 1 |

Solution:

Direct Method:

| Class interval | Mid-point (x) | Frequency (f) | fx |
|---|---|---|---|
| 15-25 | 20 | 4 | 80 |
| 25-35 | 30 | 11 | 330 |
| 35-45 | 40 | 19 | 760 |
| 45-55 | 50 | 14 | 700 |
| 55-65 | 60 | 0 | 0 |
| 65-75 | 70 | 1 | 70 |
| | | $\Sigma f = n = 49$ | $\Sigma fx = 1940$ |

Arithmetic mean $(\bar{x}) = \frac{\Sigma fx}{n} = \frac{1940}{49} = 39.53$

Shortcut Method:

| Class interval | Mid-point (x) | Frequency (f) | d = x - A(40) | fd |
|---|---|---|---|---|
| 15-25 | 20 | 4 | -20 | -80 |
| 25-35 | 30 | 11 | -10 | -110 |
| 35-45 | 40 | 19 | 0 | 0 |
| 45-55 | 50 | 14 | 10 | 140 |
| 55-65 | 60 | 0 | 20 | 0 |
| 65-75 | 70 | 1 | 30 | 30 |
| | | $\Sigma f = n = 49$ | | $\Sigma fd = -20$ |

Arithmetic mean $(\bar{x}) = A + \frac{\Sigma fd}{n} = 40 + \frac{-20}{49} = 39.59$

Step Deviation Method

| Class interval | Mid-point (x) | Frequency (f) | $d' = \frac{x-A}{h}$ | $fd'$ |
|---|---|---|---|---|
| 15-25 | 20 | 4 | 0 | 0 |
| 25-35 | 30 | 11 | 1 | 11 |
| 35-45 | 40 | 19 | 2 | 38 |
| 45-55 | 50 | 14 | 3 | 42 |
| 55-65 | 60 | 0 | 4 | 0 |

| | | | | |
|---|---|---|---|---|
| 65-75 | 70 | 1 | 5 | 5 |
| | | $\Sigma f = n = 49$ | | $\Sigma fd' = 96$ |

Arithmetic mean $(\bar{x}) = A + \frac{\Sigma fd'}{n} \times h = 20 + \frac{96}{49} \times 10 = 20 + 19.59 = 39.59$

4. The wages (in Rs.) of 30 workers in a factory are as follows:

   262, 265, 250, 255, 258, 266, 265, 262, 254, 269
   285, 288, 272, 283, 282, 284, 288, 283, 273, 275
   279, 278, 278, 275, 276, 277, 278, 295, 296, 285

   If the factory gives bonus of Rs. 15, 20, 25, 30, 35 in different wages groups and Rs. 270 to Rs. 280 be one of the class intervals of wages. Calculate the average bonus by the factory.

Solution:

Calculation of Average Bonus

| Wages (Rs.) | No. of workers (f) | Bonus (x) | fx |
|---|---|---|---|
| 250 – 260 | 4 | 15 | 60 |
| 260 – 270 | 6 | 20 | 120 |
| 270 – 280 | 10 | 25 | 250 |
| 280 – 290 | 8 | 30 | 240 |
| 290 – 300 | 2 | 35 | 70 |
| | $\Sigma f = n = 30$ | | $\Sigma fx = 740$ |

Arithmetic mean $(\bar{x}) = \frac{\Sigma fx}{n} = \frac{740}{30} = \text{Rs. } 24.66$

5. The number of days that students were missing from school due to sickness in one semester was recorded as:

| Number of days off sick | 1 – 5 | 6 – 10 | 11 – 15 | 16 – 20 | 21 – 25 |
|---|---|---|---|---|---|
| Frequency | 12 | 11 | 10 | 4 | 3 |

   Estimate the mean using direct, shortcut and step deviation method.

6. The table below gives data on the heights, in cm, of 51 children.

| Class Interval | 140≤h<150 | 150≤ h<160 | 160≤h<170 | 170≤h<180 |
|---|---|---|---|---|
| Frequency | 6 | 16 | 21 | 8 |

7. A salesman keeps a record of the number of shops he visits each day.

| *Shops visited* | 0 – 9 | 10 – 19 | 20 – 29 | 30 – 39 | 40 – 49 |
|---|---|---|---|---|---|
| *Frequency* | 3 | 8 | 24 | 60 | 21 |

a. Estimate the mean number of shops visited. Answer: 32.1
b. Estimate the median. Answer 33.33
c. What is the modal class?

8. The weights of a number of students were recorded in kg.

| *Weight (kg)* | 30≤w<35 | 35≤w<40 | 40≤w<45 | 45≤w<50 | 50≤w<55 |
|---|---|---|---|---|---|
| *Frequency* | 10 | 11 | 15 | 7 | 4 |

Find Q1 and Q3.

Solution:

| Weight (kg) | Frequency | Cumulative Frequency (cf) |
|---|---|---|
| 30≤w<35 | 10 | 10 |
| 35≤w<40 | 11 | 21 |
| 40≤w<45 | 15 | 36 |
| 45≤w<50 | 7 | 43 |
| 50≤w<55 | 4 | 47 |
| | $\Sigma f = n = 47$ | |

Now,

$Q_1$ = Size of $\frac{N}{4}$ th item
= Size 11.75 the item
= 35 – 40

Calculating the value of $Q_1$,

$$Q_1 = l + \frac{\frac{N}{4} - cf}{f} \times h$$

$$= 35 + \frac{\frac{47}{4} - 10}{11} \times 5$$

$$= 35.8$$

$Q_3$ = Size of $\frac{3N}{4}$ th item
= Size 35.25 the item
= 40≤w<45

Calculating the value of $Q_3$,

$$Q_1 = l + \frac{\frac{3N}{4} - cf}{f} \times h$$

$$= 40 + \frac{35.25 - 21}{15} \times 5$$

$$= 44.75$$

9. Find $P_5, P_{29}\ and\ P_{50}$ from the following data.

| Marks | 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 - 60 |
|---|---|---|---|---|---|---|
| No. of Students | 10 | 20 | 30 | 50 | 40 | 30 |

Solution:

| Marks | Frequency | Cumulative Frequency (cf) |
|---|---|---|
| 0 – 10 | 10 | 10 |
| 10 – 20 | 20 | 30 |
| 20 – 30 | 30 | 60 |
| 30 – 40 | 50 | 110 |
| 40 – 50 | 40 | 150 |
| 50 – 60 | 30 | 180 |
| | $\Sigma f = n = 180$ | |

Now,

$$P_5 = size\ of\ \frac{5N}{100}\ th\ item$$
$$= size\ of\ 9\ th\ item$$

$$= 0 - 10$$

Calculating the value of $P_5$,

$$P_{29} = l + \frac{\frac{5N}{100} - cf}{f} \times h$$

$$= 20 + \frac{9 - 30}{30} \times 10$$

$$= 27.4$$

$$P_{50} = size\ of\ \frac{50N}{100}\ th\ item$$

$$= \ size\ of\ 90\ th\ item$$

$$= 30 - 40$$

Calculating the value of $P_{50}$,

$$P_{50} = l + \frac{\frac{50N}{100} - cf}{f} \times h$$

$$= 30 + \frac{90 - 60}{50} \times 10$$

$$= 36$$

10. The weights of a number of students were recorded in kg.

| *Weight (kg)* | 30≤*w*<35 | 35≤*w*<40 | 40≤*w*<45 | 45≤*w*<50 | 50≤*w*<55 |
|---|---|---|---|---|---|
| *Frequency* | 10 | 11 | 15 | 16 | 4 |

a. Estimate the mean weight.
b. Estimate the median.
c. What is the modal class?

11. A stopwatch was used to find the time that it took a group of students to run 100 m.

| *Time (sec.)* | $10 \le t < 15$ | $15 \le t < 20$ | $20 \le t < 25$ | $25 \le t < 30$ |
|---|---|---|---|---|
| *Frequency* | 6 | 16 | 21 | 8 |

a. Is the median in the modal class?
b. Estimate the median.
c. Estimate the mean.
d. Is the median greater or less than the mean?

12. The distances that students in a year group travelled to school is recorded.

| *Distance (km)* | $0 \le d < 0.5$ | $0.5 \le d < 1.0$ | $1.0 \le d < 1.5$ | $1.5 \le d < 2.0$ |
|---|---|---|---|---|
| *Frequency* | 30 | 22 | 19 | 8 |

a. Does the modal class contain the median?
b. Estimate the median and the mean.
c. Which is the larger, the median or the mean?

13. The ages of the people at a youth camp are summarized in the table below.

| *Age (years)* | 6 – 8 | 9 – 11 | 12 – 14 | 15 – 17 |
|---|---|---|---|---|
| *Frequency* | 8 | 22 | 29 | 5 |

a. Estimate the mean age.

14. The lengths of a number of leaves collected for a project are recorded.

| *Length (cm)* | 2 – 5 | 6 – 10 | 11 – 15 | 16 – 25 |
|---|---|---|---|---|
| *Frequency* | 8 | 20 | 42 | 12 |

Estimate (a) the mean (b) the median length of a leaf.

15. The table shows how many nights people spend at a campsite.

| *Number of nights* | 1 – 5 | 6 – 10 | 11 – 15 | 16 – 20 | 21 – 25 |
|---|---|---|---|---|---|
| *Frequency* | 20 | 26 | 32 | 5 | 2 |

a. Estimate the mean.
b. What is the modal class?
c. Estimate the median.

16. (a) A teacher notes the number of correct answers given by a class on a multiple-choice test.

| *Correct answers* | 1 – 10 | 11 – 20 | 21 – 30 | 31 – 40 | 41 – 50 |
|---|---|---|---|---|---|
| *Frequency* | 2 | 8 | 15 | 11 | 3 |

(i) Estimate the mean.
(ii) Estimate the median.
(iii) What is the modal class?

(b) Another class took the same test. Their results are given below.

| *Correct answers* | 1 – 10 | 11 – 20 | 21 – 30 | 31 – 40 | 41 – 50 |
|---|---|---|---|---|---|
| *Frequency* | 3 | 14 | 20 | 2 | 1 |

(i) Estimate the mean.
(ii) Estimate the median.
(iii) What is the modal class?

(c) How do the results for the two classes compare?

17. 29 students are asked how much money they were given at their last birthday. Their replies are shown in this frequency table.

| *'Birthday money'* £ | *Frequency* *f* |
|---|---|
| 0 – £10.00 | 12 |
| £10.01 – £20.00 | 9 |
| £20.01 – £30.00 | 6 |
| £30.01– £40.00 | 2 |

a. Which is the modal class?
b. Calculate an estimate of the mean amount of money received per student.

18. In an experiment, 50 people were asked to estimate the length of a rod to the nearest centimeter. The results were recorded.

| *Length* (cm) | 20 21 22 23 24 25 26 27 28 29 |
|---|---|
| *Frequency* | 0 4 6 7 9 10 7 5 2 0 |

a. Find the value of the median.
b. Calculate the mean length.
c. In a second experiment another 50 people were asked to estimate the length
of the same rod. The most common estimate was 23 cm. The range of the estimates was 13 cm.
Make two comparisons between the results of the two experiments

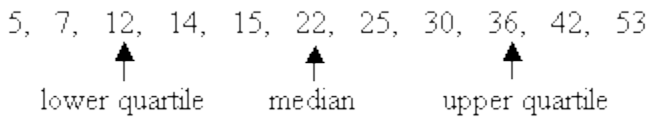
***Example :***

1. Find the median, lower quartile and upper quartile of the following numbers.

12, 5, 22, 30, 7, 36, 14, 42, 15, 53, 25

***Solution:***

First, arrange the data in ascending order:




Median (middle value) = 22

Lower quartile (middle value of the lower half) = 12

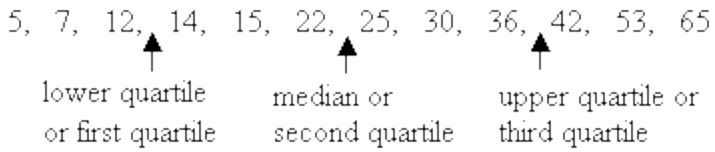
Upper quartile (middle value of the upper half) = 36

2. Find the median, lower quartile, upper quartile of the following numbers.

   12, 5, 22, 30, 7, 36, 14, 42, 15, 53, 25, 65

   ***Solution:***

   First, arrange the data in ascending order:




**Lower quartile or first quartile** $= \frac{12+14}{2} = 13$

**Median or second quartile** $= \frac{22+25}{2} = 23.5$

Third Quartile $= \frac{36+42}{2} = 39$