**1.** **Find the arithmetic mean in each of the following:**

    (i)       4, 6, 10, 12, 15, 20, 25, 28, 30.

    (ii)     12, 18, 19, 0, −19, −18, −12

    (iii)    6.5, 11, 12.3, 9, 8.1, 16, 18, 20.5, 25

    (iv)    8, 10, 12, 14, 16, 20, 22

***Sol:*** (i) Arithmetic Mean of 4, 6, 10, 12, 15, 20, 25, 28, 30

$$x = 9$$

$$\Sigma x = 4 + 6 + 10 + 12 + 15 + 20 + 25 + 28 + 30$$

$$= 150$$

$$\bar{x} = \frac{150}{9} = 16.67$$

(ii) Arithmetic Mean of 12, 18, 19, 0, − 19 − 18, − 12.

$$x = 7$$

$$\Sigma x = 12 + 18 + 19 + 0 - 19 - 18 - 12 = 0$$

$$\bar{x} = \frac{0}{7} = 0$$

(iii) Sum of numbers $= 6.5 + 11 + 12.3 + 9 + 8.1 + 16 + 18 + 20.5 + 2.5$

$$x = 9$$

$$\Sigma x = 6.5 + 11 + 12.3 + 9 + 8.1 + 16 + 18 + 20.5 + 2.5$$

$$\bar{x} = \frac{126.4}{9} = 14.04$$

(iv) Sum of Numbers $8 + 10 + 12 + 14 + 16 + 20 + 22$

$$x = 7$$

$$\Sigma x = 8 + 10 + 12 + 14 + 16 + 20 + 22 = 102$$

$$\overline{x} = \frac{102}{7} = 14.57$$

**2.** **Following are the heights in (inches) of 12 students. Find the median height.**

**55, 53, 54, 58, 60, 61, 62, 56, 57, 52, 51, 63.**

*Sol:* Median height of 12 students (in inches) 55, 53, 54, 58, 60, 61, 62, … 56, 57, 52, 51, 63

$x = 12$ even number. The median is the average of $\left(\frac{x}{2}\right)^{th}$

and $\left(\frac{x}{2} + 1\right)^{th}$ term.

Ascending order

51, 52, 53, 54, 55, 56, 57, 58, 60, 61, 62, 63

Median is $\frac{x}{2}^{th}$ (6th) and $\left(\frac{x}{2} + 1\right)$ 1$^{st}$ (7$^{th}$) terms.

i.e.    Average of 56 and 57  $= \frac{56 + 57}{2} = \frac{113}{2} = 56.5$

**3.** **Following are the earnings (in Rs.) of ten workers:**

**88, 70, 72, 125, 115, 95, 81, 90, 95, 90. Calculate**

**(i)    Arithmetic Mean    (ii)    Median**

**(iii)    Mode**

*Sol:* Earnings of 10 workers are: 80, 70, 72, 125, 115, 95, 81, 90, 95, 90.

Ascending order:

70, 72, 81, 88, 90, 90, 95, 95, 115, 125.

Arithmetic Mean

$x = 10$

$\Sigma x = 70 + 72 + 88 + 81 + 90 + 90 + 95 + 95 + 115 + 125$

$= 921$

$$\overline{x} = \frac{921}{10} = 92.1$$

There are 10 terms so median is the Average of 5th $\left(\dfrac{x}{2} = \dfrac{10}{2} = 5\right)$ and 6th term.

$$\text{Median} = \dfrac{90 + 90}{2} = 90$$

Mode is 90, 95.

4. **The Marks obtained by the students in the subject of English are given below.**

| Marks | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 |
|---|---|---|---|---|---|
| Frequency | 9 | 18 | 35 | 17 | 5 |

Find: (i) Arithmetic mean of their marks by direct and short formula.

(ii) Median of their marks.

**Sol:**

| Marks obtained | 15 – 19 | 20 – 24 | 25 – 29 | 30 – 34 | 35 – 39 | |
|---|---|---|---|---|---|---|
| Frequency (f) | 9 | 18 | 35 | 17 | 5 | $\Sigma f = 84$ |
| Class mid points | 17 | 22 | 27 | 32 | 37 | |
| x.f. | 153 | 396 | 945 | 544 | 185 | $\Sigma fx = 2223$ |

$$\bar{x} = \dfrac{2223}{84} = 26.46$$

Cumulative frequency = 9   27   62   79   84

5. **Given below is a frequency distribution.**

| Class Interval | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 |
|---|---|---|---|---|---|
| Frequency | 1 | 8 | 18 | 11 | 2 |

Find the mode of the frequency distribution.

**Sol:**

| Class Interval | 5 – 9 | 10 – 14 | 15 – 19 | 20 – 24 | 25 – 29 |
|---|---|---|---|---|---|
| Frequency | 4.5 – 9.5 | 9.5 – 14.5 | 14.5 – 19.5 | 19.5 – 24.5 | 24.5 – 29.5 |
| | 1 | 8 | 18 | 11 | 2 |

$$f_m = 18$$

$$f_1 = 8 \qquad\qquad f_2 = 11$$
$$h = 5 \qquad\qquad l = 14.5$$

(i) Mode $= 14.5 + \dfrac{(18 - 8)5}{(18 - 8) + (18 - 11)}$

$$= 14.5 + \dfrac{10 \times 5}{10 + 7}$$

$$= 14.5 + \dfrac{50}{17}$$

$$= 14.5 + 2.94$$

$$= 17.44 \qquad \text{Ans.}$$

**6. Ten boys work on a petrol pump station. They get weekly wages as follows: Wages (in Rs.) 4250, 4350, 4400, 4250, 4350, 4410,4500, 4300, 4500, 4390. Find the arithmetic mean by short formula, median and mode of their wages.**

*Sol:* Wages of 10 boys 4250, 4350, 4400, 4250, 4350, 4410, 4500, 4300, 4500, 4390.

Wages in Ascending order

4250, 4250, 4300, 4350, 4350, 4390, 4400, 4410, 4500, 4500

Total number of figures 10

Median is $\dfrac{10}{2} . \dfrac{(5^{th} \text{ term} + 6^{th} \text{ term})}{2}$

$$= \dfrac{4350 + 4390}{2} = 4370$$

There are three modes 4250; 4350; 4500

Arithmetic Mean $= \bar{x} = 4370$

**7. The arithmetic mean of 45 numbers is 80. Find their sum.**

*Sol:* $\qquad\qquad$ A.M. $= 45$

$$x = 80$$

$$\Sigma x = \text{sum} = 3600$$

**8.** Five numbers are 1, 4, 0, 7, 9. Find their mean, median and mode.

**Sol:** Members are 1, 4, 0, 7, 9

Ascending order 0, 1, 4, 7, 9.

$$\Sigma x = 0 + 1 + 4 + 7 + 9 = 21$$

$$x = 5$$

$$A.M. = \frac{21}{5} = 4.2$$

$$\text{Median} = \frac{x + 1}{2} = \frac{5 + 1}{2} = \frac{6}{2} = 3^{rd} = 4$$

No mode.

**9.** A set of data contains the values as 148, 145, 160. 157, 156, 160.

Show that Mode > Median > Mean.

**Sol:** Members are 148, 145, 160, 157, 156, 160

Ascending order 145, 148, 156, 157, 160, 160.

$$\Sigma x = 145 + 148 + 156 + 157 + 160 + 160 = 910$$

$$x = 6$$

$$\text{Arithmetic Mean} = \frac{910}{6} = 151.67$$

$$\text{Mode} = 160$$

$$\text{Median} \frac{6}{2} = \frac{3^{rd} + 4^{th}}{2} = \frac{156 + 157}{2} = \frac{313}{2} = 156.5$$

Mode = 160, Median = 156.5, Mean = 151.67

Clearly mode > Median > A.M.

**10.** The monthly attendance of 10 students for their lunch in the hostel is recorded as: 21, 15, 16, 18, 14, 17, 15, 12, 13, 11. Find the median and mode of the attendance.

Also find the mean if $D = A - 20$.

**Sol:** Numbers are 21, 15, 16, 18, 14, 17, 15, 12, 13, 11 = 152

$$n = 10$$

Ascending order 11, 12, 13, 14, 15, 15, 16, 17, 18, 21

$$\text{Mode} = 15$$

$$\text{Median} = \frac{5^{th} + 6^{th}}{2} = \frac{15 + 15}{2} = 15$$

$$\Sigma x = 152$$

$$\text{A.M.} = \frac{152}{10} = 15.2$$

**11.** On a prize distribution day, 50 students brought pocket money as under:

| Rupees | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 |
|--------|------|-------|-------|-------|-------|
| Frequency ($f$) | 12 | 9 | 18 | 7 | 4 |

(i) Find the median and mode of the above data.

(ii) Find the arithmetic mean of the data given above using coding method.

**Sol:**

| Rupees | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 | 25 – 30 | |
|--------|--------|---------|---------|---------|---------|---|
| Frequency | 7.5 | 12.5 | 17.5 | 22.5 | 27.5 | $\Sigma f = 50$ |
| | 12 | 9 | 18 | 7 | 4 | |

Mode class = 15 – 20  Median class = 15 – 20

$$f_m = 18$$

$$\text{Median} = l + 5\left(\frac{18 - 9}{(18 - 9) + (18 - 7)}\right)$$

$$f_1 = 9 \qquad = 15 + \frac{5 \times 9}{9 + 11} \quad 15 + \frac{45}{20} = 15 + 2.5$$

$$f_2 = 7 \qquad = 17.25 \qquad \Sigma f = 50$$

$$l = 15 \qquad = 17.25$$

$$h = 5 \qquad \text{mode} = 17.25 \qquad \text{A.M.} = 15.7$$

**12.** The arithmetic mean of the ages of 20 boys is 13 years, 4 months and 5 days.

Find the sum of their ages. If one of the boys is of age exactly 15 years. What is the average age of the remaining boys?

**Sol:** A.M = 13 years 4 month 5 days

No. of boys = 20

Sum of the ages $(13 - 4 - 5)20 = 266$ years, $11 - 10$ days

Balance age $266y - 11m - 10d - (15y) = 251y - 11m - 10d$

$$= \frac{(25 \text{years} - 11 \text{months} - 10 \text{days})}{19} = 13 \text{ year}$$

**13.** **Calculate the arithmetic mean from the following information:**

   (i)     If $D = X - 140$, $\Sigma D = 500$ and $n = 10$

   (ii)    If $U = \dfrac{x - 130}{6}$, $\Sigma U = -150$ and $n = 15$

   (iii)   If $D = x - 25$, $\Sigma f D = 300$ and $\Sigma f = 20$

   (vi)    If $U = \dfrac{x - 120}{5}$, $\Sigma f U = 60$ and $\Sigma f = 100$

**Sol:** (i)  $D = x - 140$            $\Sigma D = 500$            $x = 10$

   $\therefore \quad 50 = x - 140$            $D = \dfrac{\Sigma D}{10} = \dfrac{500}{10} = 50$

   or   $x = 50 + 140 = 190$

   (ii)        $u = \dfrac{x - 130}{6}$

   $6u = x - 130$        $\Sigma u = -150,$    $x = 15$

   $x = 6u + 130$        $u = -10$

   $= 6(-10) + 130 = 70$

   (iii)    $\Sigma f D = 300$, $\Sigma f = 20 \therefore D = \dfrac{300}{20} = 15$

   $D = x - 25$        $\therefore x = D + 25$    $\therefore x = 15 + 25 = 40$

   (iv)    $u = \dfrac{x - 120}{5}$, $\Sigma f u = 60$, $\Sigma f = 100$, $u = \dfrac{60}{100} = 0.5$

   $6 = x - 120$

   $3 = x - 120$        or        $x = 123$

**14.** The three children Haris, Maham and Minal made the following scores in a game conducted by a group of teachers in the school.

| Haris scores | 50 | 55 | 70 | 85 | 90 |
|---|---|---|---|---|---|
| Maham scores | 75 | 60 | 60 | 45 | 53 |
| Minal scores | 80 | 77 | 66 | 42 | 48 |

It is decided that the candidate who gets the highest average score will be awarded rupees 1000. Who will get the awarded amount?

*Sol:* Average of Mr. Haris $= \dfrac{50 + 55 + 70 + 85 + 90}{5} = 70$

Average of Maha $= \dfrac{75 + 60 + 60 + 45 + 53}{5} = 58.6$

Average of Minal $= \dfrac{80 + 77 + 66 + 42 + 48}{5}$

$= \dfrac{313}{5} = 62.6$

Award goes to Haris.

**15.** Given below is a frequency distribution derived by making a substitution as $D = X - 20$. Calculate the arithmetic mean.

| D | −6 | −4 | −2 | 0 | 2 | 4 | 6 |
|---|---|---|---|---|---|---|---|
| f | 1 | 3 | 6 | 20 | 26 | 12 | 2 |

*Sol:*

| D | − 6 | − 4 | − 2 | 0 | 2 | 4 | 6 | |
|---|---|---|---|---|---|---|---|---|
| f | 1 | 3 | 6 | 20 | 26 | 12 | 2 | $\Sigma f = 70$ |
| D×f | − 6 | − 12 | − 12 | 0 | 52 | 48 | 12 | $\Sigma F \times D = 82$ |

$- 30 + 112 = 82$

$\bar{x} = A + \dfrac{\Sigma f.D}{\Sigma f} = 20 + \dfrac{82}{70} = 20 + 1.17 = 21.17$

**16.** Being partners Hafsa and Fatima took part in a quiz programme. They made the following number of points 45, 51, 58, 61, 74. 48, 46 and 50. Compute the average number of points using deviation D = x - 58.

| Interval (Points $x$) | Deviation $D = x - 58$ |
|---|---|
| 45 | – 13 |
| 46 | – 12 |
| 48 | – 10 |
| 50 | – 8 |
| 51 | – 7 |
| 58 | 0 |
| 61 | 3 |
| 74 | 16 |
| $\Sigma D$ | – 31 |

No. of points = 8

If $\bar{x}$ is the average

then, $\quad \bar{x} = A + \dfrac{\Sigma D}{f}$

$= 58 + \dfrac{-31}{8}$

$= 58 - 3.875$

$= 54.125$

$\bar{x} = 54.13$

**17.** A person purchased the following food items:

| Food item | Quantity (in Kg) | Cost per Kg (in Rs.) |
|---|---|---|
| Rice | 10 | 96 |
| Flour | 12 | 48 |
| Ghee | 4 | 190 |
| Sugar | 3 | 49 |
| Mutton | 2 | 650 |

What is the weighted mean of cost of food items per kg?

| Food item | Quantity (kg) | Cast per kg | Price paid | |
|---|---|---|---|---|
| Rice | 10 | 96 | 960 | |
| Flour | 12 | 48 | 576 | |
| Ghee | 4 | 190 | 760 | |
| Sugar | 3 | 49 | 147 | |
| Mutton | 2 | 650 | 1300 | |
| Total price/ weight | 31 | | 3743 | Mean weight $= \dfrac{3743}{31}$ |

$= Rs. 12074/kg$

**18.** For the following data, find the weighted mean.

| Item | Quantity | Cost of item (in thousands) |
|---|---|---|
| Washing Machine | 5 | 35 |
| Heater | 3 | 5 |
| Stove | 2 | 13 |
| Dispenser | 6 | 18 |

*Sol:*

| Item | Quantity | Cost of item in thousands | Total cost |
|---|---|---|---|
| Washing machine | 5 | 35 | 175000 |
| Heater | 3 | 5 | 15000 |
| Stove | 2 | 13 | 26000 |
| Dispenser | 6 | 18 | 108000 |

Average cost per item

$$= \frac{324000}{16}$$

$= 20250$ per item

$= 20.25$ (in thousands)

**19.** A company is planning its next year marketing budget across five years: yearly budgets (in million) are: 5, 7, 8, 6, 7. Find the average budget for the next year.

*Sol:*   Total budget for 5 years $= 5 + 7 + 8 + 6 + 7$

$$= 33 \text{ millions}$$

Average per year $= \frac{33}{6} = 5.5$ million per year

**20.** Ahmad obtained the following marks in a certain examination. Find the weighted mean if weights 5, 4, 2, 3, 2, 4 respectively are allotted to the subjects.

| Urdu | English | Science | Math | Islamiyat | Computer |
|---|---|---|---|---|---|
| 78 | 65 | 80 | 90 | 85 | 72 |

| Paper | Urdu | English | Science | Math | Islamiyat | computer |
|---|---|---|---|---|---|---|
| %obtained | 78 | 65 | 80 | 90 | 85 | 72 |
| Paper weightage | 5 | 4 | 2 | 3 | 2 | 4 |
| Relative weight of each paper | 390 | 260 | 160 | 270 | 170 | 288 |

$$\Sigma \%\text{weight} = 1538$$

$\Sigma\text{weight}\ 5 + 4 + 2 + 3 + 2 + 4 = 20$

$$\text{Mean weightage} = \frac{1538}{20} = 76.9 \text{ Marks}$$