Solution.

(*a*) COMPUTATION OF MEAN

x	f	fx
1	5	5
2	9	18
3	12	36
4	17	68
5	14	70
6	10	60
7	6	42
Total	73	299

$$\therefore \quad \bar{x} = \frac{1}{N}\sum fx = \frac{299}{73} = 4{\cdot}09$$

(*b*) COMPUTATION OF MEAN

Marks	*No. of Students* (f)	*Mid-point* (x)	fx
0—10	12	5	60
10—20	18	15	270
20—30	27	25	675
30—40	20	35	700
40—50	17	45	765
50—60	6	55	330
Total	100		2,800

Arithmetic mean ($\bar{x}$)

$$= \frac{1}{N}\sum fx = \frac{1}{100} \times 2{,}800 = 28$$

It may be noted that if the values of x or (and) f are large, the calculation of mean by formula (2·1*a*) is quite time-consuming and tedious. The arithmetic is reduced to a great extent by taking the deviations of the given values from any arbitrary point 'A' as explained below :

Let $d_i = x_i - A$. Then $f_i d_i = f_i (x_i - A) = f_i x_i - A f_i$

Summing both sides over i from 1 to n, we get

$$\sum_{i=1}^{n} f_i d_i = \sum_{i=1}^{n} f_i x_i - A \sum_{i=1}^{n} f_i = \sum_{i=1}^{n} f_i x_i - A \, . \, N$$

$$\Rightarrow \quad \frac{1}{N}\sum_{i=1}^{n} f_i d_i = \frac{1}{N}\sum_{i=1}^{n} f_i x_i - A = \bar{x} - A,$$

where $\bar{x}$ is the arithmetic mean of the distribution.

$$\therefore \quad \bar{x} = A + \frac{1}{N}\sum_{i=1}^{n} f_i d_i \qquad \ldots(2{\cdot}2)$$

$$\boxed{\bar{x} = A + \frac{h}{N} \sum_{i=1}^{n} f_i d_i} \qquad \ldots (2\cdot3)$$

Example 2·2. *Calculate the mean for the following frequency distribution :*

Class interval :	*0—8*	*8—16*	*16—24*	*24—32*	*32—40*	*40—48*
Frequency :	*8*	*7*	*16*	*24*	*15*	*7*

Solution. Here we take $A = 28$ and $h = 8$.

COMPUTATION OF MEAN

Class interval	*Mid-value* (x)	*Frequency* (f)	$d = \frac{x-A}{h}$	fd
0—8	4	8	−3	−24
8—16	12	7	−2	−14
16—24	20	16	−1	−16
24—32	28	24	0	0
32—40	36	15	1	15
40—48	44	7	2	14
Total		77		−25

$$\bar{x} = A + \frac{h \sum fd}{N}$$

$$= 28 + \frac{8 \times (-25)}{77}$$

$$= 28 - \frac{200}{77}$$

$$= 25\cdot404$$

2.5.1 Properties of Arithmetic Mean

... of those retained in the industrial house is 47 years.

2·5·2. Merits and Demerits of Arithmetic Mean

Merits	Demerits
1. It is rigidly defined.	1. It cannot be determined by inspection nor it can be located graphically.
2. It is easy to understand and easy to calculate.	2. Arithmetic mean cannot be used if we are dealing with qualitative characteristics which cannot be measured quantitively; such as, intelligence, honesty, beauty, etc.
3. It is based upon all the observations.	3. Arithmetic mean cannot be obtained if a single observation is missing or lost or is illegible unless we drop it out and compute the arithmetic mean of the remaining values.
4. It is amenable to algebraic treatment. The mean of the composite series in terms of the means and sizes of the component series is given by : $\bar{x} = \sum_{i=1}^{k} n_i \bar{x}_i / (\sum_{i=1}^{k} n_i)$	4. Arithmetic mean is affected very much by extreme values. In case of extreme items, arithmetic mean gives a distorted picture of the distribution and no longer remains representative of the distribution.
5. Of all the averages, arithmetic mean is affected least by fluctuations of sampling. This property is sometimes described by saying that arithmetic mean is a *stable* average. Thus, we see that arithmetic mean satisfies all the properties laid down by Prof. Yule for an ideal average.	5. Arithmetic mean may lead to wrong conclusions if the details of the data from which it is computed are not given. Let us consider the following marks obtained by two students *A* and *B* in three tests, *viz*., terminal test, half-yearly examination and annual examination respectively. *Marks* — *I Test*, *II Test*, *III Test*, *Average* *A* — 50%, 60%, 70%, 60% *B* — 70%, 60%, 50%, 60% Thus average marks obtained by each of the two students at the end of the year are 60%. If we are given the average marks alone we conclude that the level of intelligence of both the students at the end of the year is same. This is a fallacious conclusion since we find from the data that student *A* has improved consistently while student *B* has deteriorated consistently.
	6. Arithmetic mean cannot be calculated if the extreme class is open, *e.g.*, below 10 or above 90.
	7. In extremely asymmetrical (skewed) distribution, usually arithmetic mean is not a suitable measure of location.