(iii) In particular if $n_1 = n_2 \cdots = n_k$, then

$$\bar{x} = \frac{\bar{x}_1 + \bar{x}_2 + \cdots + \bar{x}_k}{k}$$, i.e., the mean of the combined data is equal to the mean of the means of the individual groups when there is an equal number of values in each group.

Example 3.7 The mean age of a group of 20 girls is 15 years and that of a group of 25 boys is 24 years. If the two groups are taken together to form a new group, what is the mean age of this group?

Solution: Let n_1 = number of girls = 20
n_2 = number of boys = 25

$\bar{x}_1$ = mean age of the girls = 15 years
$\bar{x}_2$ = mean age of the boys = 24 years

Suppose $\bar{x}$ is the mean age of the new group.

Then $$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2} = \frac{20 \times 15 + 25 \times 24}{20 + 25}$$

$$= \frac{300 + 600}{45} = \frac{900}{45} = 20 \text{ (years)}$$

(ii) Median: The median of a variable is is defined as the middlemost value when its values are arranged in ascending or descending order of magnitude. In other words, the median divides the whole set of values in two parts such that half of the observations are less than or equal to it and half are more than or equal to it.

If the total number of given values n, say, is an odd number, then there exists only one middlemost value, namely, the $\frac{n+1}{2}$ th value in the arrangement and it represents the median of the values.

If n be even, median may not be uniquely determined. In fact, any possible value between the two middle values, namely $\frac{n}{2}$ th and the $\left(\frac{n}{2}+1\right)$ th values in the ordered arrangement, may be taken as median. But in order to obtain a definite value, the arithmetic mean of $\frac{n}{2}$ th and $\left(\frac{n}{2}+1\right)$ th values is regarded as the median of the set of values, by convention.

Example 4.8 : The score of 9 students in Economics in a class test were found to be

40, 37, 41, 38, 31, 37, 44, 45, 42

Find the median

Solution: To find the median, at the outset, the given values are arranged in ascending order of magnitude in the form

$$31, 37, 37, 38, 40, 41, 42, 44, 45$$

Here the total number of given values is 9, an odd number

So, the median of the score is the $\left(\frac{9+1}{2}\right)$ th, i.e., the 5th value in this arrangement. Hence

median = 40.

In connection with the frequency distribution of a discrete variable, the cumulative frequencies indicate an arrangement of different values in an ascending or descending order of magnitude, depending on their type (i.e., less-than or more-than). Let us consider a variable x which assumes five distinct values $x_1, x_2, \ldots, x_5$ with $F_1, F_2, \ldots, F_5$ as their corresponding less-than type cumulative frequencies; then it means that first F_1 values are all equal to x_1, (F_1+1) th value to F_2 th value are all equal to x_2 and so on. Here F_5 indicates the total number of observations and on the basis of its odd or even value, the median of x can be obtained.

In relation to the frequency distribution of a continuous variable, the median is regarded as the value for which the cumulative frequency is $\frac{n}{2}$.

The approximate value of the Median (Me) is given by

$$Me = l + \frac{\frac{n}{2} - F_l}{f_{Me}} \times c$$ where

n is the total no. of observations, l is the lower boundary of the median class, f_{Me} is the frequency of the median class, c is the width of the class containing the median (i.e, median class) and F_l is the cumulative frequency of less-than type upto l.

Example 4.9

The median of the following frequency distribution of marks of 100 students is 32. Find the missing frequencies

Marks :	0-10	10-20	20-30	30-40	40-50	50-60
No. of students :	10	–	25	30	–	10

Solution : Let f_1 and f_2 respectively denote number of students in the interval 10-20 and 40-50.