Assignment 1
AI1110: Probability and Random Variables

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Question 3(c):

The marks of 10 students of a class in an examination arranged in ascending order is as follows:

13, 35, 43, 46, x, x+4, 55, 61, 71, 80.

If the median marks is 48, find the value of x. Hence find the mode of the given data.

Solution:

Required:

(i) value of x.

(ii) mode of the data.

Median(definition): it is the middle number in a sorted ordered list of number.

i.e., if n be the number of entries in given data then median of the data is:

(i) if n = odd, Median = $(\frac{n}{2})^{th}$ element.

(ii) if (n = even), Median = average of $(\frac{n}{2})^{th}$ and $(\frac{n+1}{2})^{th}$ elements.

As, Here the value of n is odd.

therefore,

$$Median = \frac{(x) + (x+4)}{2}. \tag{1}$$

$$Median = \frac{(2x+4)}{2}. \tag{2}$$

$$Median = x + 2. \tag{3}$$

$$x = Median - 2 \tag{4}$$

$$x = 48 - 2 \tag{5}$$

$$x = 46. \tag{6}$$

therefore, $\underline{x = 46.}$

Requirement (ii) : mode of the data.(Histogram)

Converting given set of sorted numbers into Class Intervals(to use Histogram method to find mode):

Given data :13, 35, 43, 46, 46, 50, 55, 61, 71, 80.

CONVERTED Class intervals and frequency table:

Class Interval	frequency
0-10	0
10-20	1
20-30	0
30-40	1
40-50	3
50-60	2
60-70	1
70-80	2

TABLE I

The mode class is first obtained by identifying the interval corresponding to the maximum marks. The mode point is then obtained as the intersection of the lines PQ and RS. The $x-$coordinate of the mode point is the desired mode. For the given problem,

$$\vec{P} = \begin{pmatrix} 50 \\ 3 \end{pmatrix}, \vec{Q} = \begin{pmatrix} 40 \\ 1 \end{pmatrix}, \tag{7}$$

$$\vec{R} = \begin{pmatrix} 40 \\ 3 \end{pmatrix}, \vec{S} = \begin{pmatrix} 50 \\ 2 \end{pmatrix} \tag{8}$$

and the desired mode is

$$\vec{M} = \begin{pmatrix} 46.667 \\ 2.333 \end{pmatrix} \tag{9}$$

Hence, Mode(approx) of given data = 46.66

i.e., **mode = 46.**

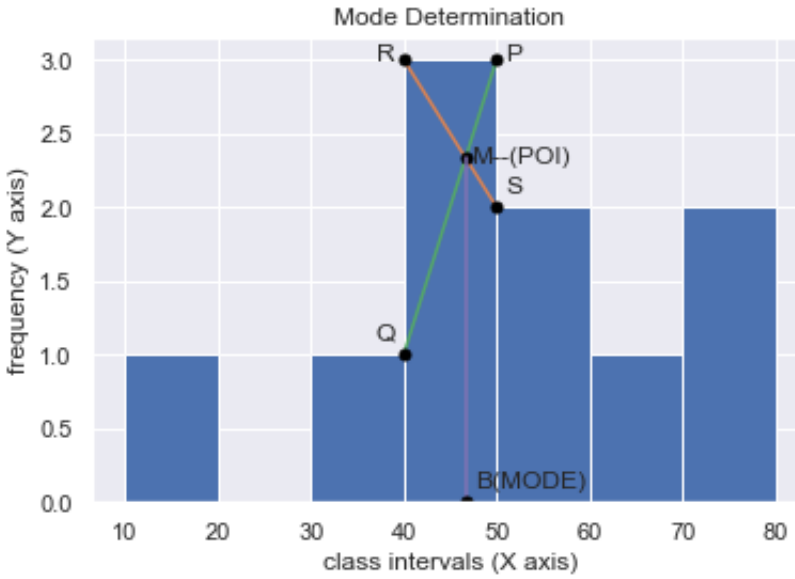

Fig. 1. Graph