MATLAB

The Language of Technical Computing

Second Course

Second Stage

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By

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Chapter One

Descriptive statistics

Mean: Represent a set of data with a single value .

If A is a vector, then mean(A) returns the mean of the elements.

If A is a matrix, then mean(A) returns a row vector containing the mean of each column.

Example 1: For the following matrix Find Mean ?

$$\begin{pmatrix} 1 & 5 & 9 \\ 7 & 15 & 22 \end{pmatrix}$$

```
x= [1 5 9;7 15 22];
M= mean(x)
M =
   4      10       15.5
MM= mean(mean(x))
MM =
   9.8333
```

Example 2:The Following data represent the weights of a sample of students consisting of 15 students who are asked to find the average weight of the student in this sample?

50.2	60.9	68.3	59.2	58.1	62.3	65.3	52.9
61.5	63.2	59.1	69.3	64.2	65.2	56.6	

SOL:

```
x=[50.2  60.9  68.3  59.2  58.1  62.3  65.3  52.9  61.5  63.2  59.1  69.3  64.2  65.2  56.6]
M=mean(x)
M =
  61.087
```

2) ***Median :*** The value of the variable (x) that divides into two equal parts .

If A is a vector, then median(A) returns the median value of A.

For matrices, median (x) is a row vector with the median value for each column.

Example 1: The following data are the ages of a sample of 12 individuals, so find the median for the age of the individual in this group?

20	22	19	26	24	27
29	18	20	24	25	28

SOL:

```
x=[20  22  19  26  24  27  28  29  18  20  24  25];
Me=median(x)
Me =
   24
```

Example 2:IF you have the following matrix Find Median?

$$X = \begin{pmatrix} 4 & 6 & 8 \\ 10 & 9 & 1 \\ 8 & 2 & 5 \end{pmatrix}$$

```
x=[4  6  8 ;10  9  1 ; 8  2  5];
Me=median(x)
Me = 8   6   5

DMe = median(median(x))
DMe = 6

ME = median(x,2)
ME =
    6
    9
    5
```

1) ***Mode :*** The most frequent value (common value)

If A is a vector, then mode(A) returns the most frequent value of A.

If A is a matrix, then mode(A) returns the mode of each column of A.

Example 1: For the Following data find the mode?

2	**3**	**2**	**4**	**2**	**5**	**4**	**4**	**5**	**4**	**6**	**8**	**9**	**4**	**7**	**3**	**7**	**6**

SOL:

```
x=[2 3 2 4 2 5 4 4 5 4 6 8 9 4 7 3 7 6];
Mo=mode(x)
Mo =
    4
```

Example 2: If we have this matrix:

$$X = \begin{pmatrix} 5 & 3 & 5 \\ 2 & 2 & 4 \\ 5 & 3 & 7 \\ 1 & 2 & 4 \end{pmatrix}$$

```
x=[5  3  5;2  2  4;5  3  7;1  2  4]
MO = mode(x)
MO =
    5     2     4
MO = mode(x,2)
MO =
    5
    2
    3
    1
```

4) Standard deviation :

S = std(x) = std(x) =std(x,0) and it is equal to $S = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}}$

S1 = std(x) = std(x,1) and it is equal to $S = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n}}$

Example 1: The Following data represent the weights of a sample of students consisting of 15 students who are asked to find the standard deviation weight of the student in this sample?

50.2	60.9	68.3	59.2	58.1	62.3	65.3	52.9
61.5	63.2	59.1	69.3	64.2	65.2	56.6	

SOL:

```
x=[50.2  60.9  68.3  59.2  58.1  62.3  65.3  52.9  61.5  63.2  59.1  69.3  64.2  65.2 56.6]
S=std(x)
ans =
   5.2922
std(x,0)
ans =
  5.2922

S1=std(x,1)
ans =
   5.1127
```

Example 2:

```
x = [ 1   5   9 ; 7   15   22 ]
S = std(x,0)
S =
   4.2426    7.0711    9.1924
```
يقوم بإيجاد الانحراف المعياري لكل عمود للقانون الأول

```
S1 = std(x,1)
ans =
   3      5      6.5
```
يقوم بإيجاد الانحراف المعياري لكل عمود للقانون الثاني

```
S=std(x,0,2)
ans =
         4
      7.5056
```
يقوم بإيجاد الانحراف المعياري لكل صف للقانون الأول

```
S1= std(x,1,2)
ans =
       3.266
      6.1283
```
يقوم بإيجاد الانحراف المعياري لكل صف للقانون الثاني

H.W\\ For the following data:

56	62	69	71	68	65	63	72	68	56

Find:

1-Mean

2- Standard deviation

5) Variance :The variance is the square of the standard deviation (std).

v = var(x,0)=var(x) and it is equal to $v = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$

v = var(x,1) and it is equal to $v = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$

Example 1: For the Following data find the variance?

2	**3**	**2**	**4**	**2**	**5**	**4**	**4**	**5**	**4**	**6**	**8**	**9**	**4**	**7**	**3**	**7**	**6**

SOL :

x = [2 3 2 4 2 5 4 4 5 4 6 8 9 4 7 3 7 6] ;

V= var(x)

V= 4.3301

S = std(x)

S= 2.0809

Example 2: For the following matrix Find variance?

$$\begin{pmatrix} 4 & -7 & 3 \\ 1 & 4 & -2 \\ 10 & 7 & 9 \end{pmatrix}$$

A = [4 -7 3; 1 4 -2; 10 7 9];

V=var(A,0)

V=

21 54.333 30.333

V1=var(A,1)

Va=

14 36.222 20.222

6) ***<u>Range</u>*** : Range(X) returns the difference between the maximum and minimum values of sample data in X.

- If X is a vector, then Range(X) is the Range of the values in X.
- If X is a matrix, then Range(X) is a Range of each column in X.

Example 1: Find the Range for the following data:

12,13,10,12,8,16,14,7,12,10

SOL:

Y=[12,13,10,12,8,16,14,7,12,10]

R=range(Y)

R= 9

Example 2:

x = [1 5 9 ; 7 15 22]

R=range(x)

R =

6 10 13

Example 2: Find the Range for the following Matrix:

$$X = \begin{pmatrix} 4 & 6 & 8 \\ 10 & 9 & 1 \\ 8 & 2 & 5 \end{pmatrix}$$

X =[4 6 8 ;10 9 1 ; 8 2 5];

R=range(X) Finds the range for each column

ans

= 6 7 7

R2=range(X,2) Finds the range for each row

ans=

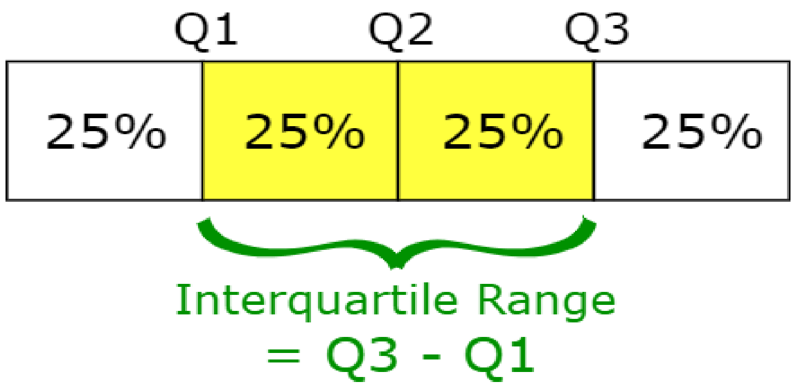
4

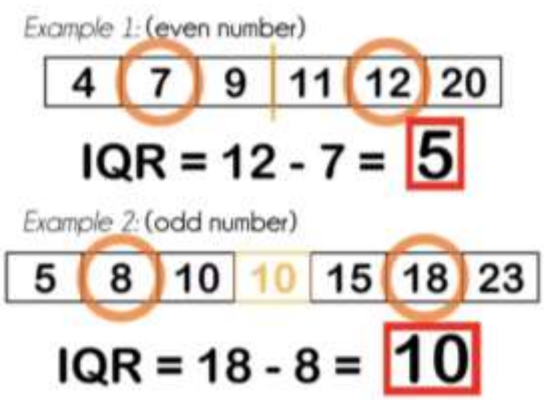
9

6

7) ***Inter-quartile Range***

Quartiles divide a ranked data set into **four equal parts**. These three measures are denoted **first quartile (denoted by** Q1**)**, **second quartile (denoted by** Q2**)**, and **third quartile (denoted by** Q3**)**. The second quartile is the same as the median of a data set.





IQR = iqr(x) returns the interquartile range of the values in x.

Example 1: For the following data find inter-quartile range :

2,7,3,5,8,6,10,12,9,11,4,1,6,13,16,14

x= [2,7,3,5,8,6,10,12,9,11,4,1,6,13,16,14]

IQR=iqr(x)

ans = 7

8) ***Skewness:*** Is a measure of symmetry.

- If X is a vector, then skewness(X) returns a scalar value that is the skewness of the elements in X.

9)Kurtosis: Is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution.

Example: IF we have the following data:

Y=0.6557 0.6787 0.6555 0.2769 0.6948 0.0357 0.7577 0.1712 0.046 0.3171 0.8491 0.7431 0.7060 0.0971 0.9502 0.9340 0.3922 0.0318 0.8235 0.0344

SOL:

```
y=[0.6557 0.6787 0.6555 0.2769 0.6948 0.0357 0.7577 0.1712 0.0462 0.3171 0.8491 0.7431 0.7060 0.0971 0.9502 0.9340 0.3922 0.0318 0.8235 0.0344]
kurtosis(y)
ans =
    1.4873

skewness(y)
ans =
    -0.2291
```

H.W \\

1) IF x= [5 8 3 5 ;4 5 7 10;8 7 2 4;8 8 2 10;2 8 2 3]

Find:

a) Mean for each column
b) Median for each rows
c) Mode for each column

2) For the following vector:

8 2 3 4 8 9 4 6 3 12 13 5 3 2

Find:

a) Mean
b) Median
c) Mode

3) For the following data:

2,2,3,4,8,2,4,5,3,5,3,4,3,2,3,4,3,2,5,3,2,9,1,1,3,1,2,1

Find:

1) The Inter-quartile range
2) Range
3) Standard Deviation
4 - Variance
5 - Skewness
6 - Kurtosis