Program

```
x<- c(45,59,32,51,56,60,51,49,25,54,54,58,70,43,58,42,50,52,
      38,67,50,59,48,65,71,30,46,55,82,51,63,45,53,40,36,56,
      70,56,70,52,67,55,30,63,42,74,58,44,55); x
mean <- sum(x)/length(x); mean
variance <- var(x); variance
sd <- sqrt(variance); sd
range <- max(x) - min(x); range
```

Output

```
mean = 53.14286
variance = 148.4167
Standard deviation = 12.18264
Range = 57.
```

Practical Sheet - 03

MEASURES OF DISPERSION

1) Calculate the standard deviation, variance and range

45, 59, 32, 51, 56, 60, 51, 49, 25, 42, 54, 54, 58, 70, 43, 58, 50, 52,
38, 67, 50, 59, 48, 65, 71, 30, 46, 55, 82, 51, 63, 45, 53, 40, 36,
56, 70, 56, 70, 52, 67, 55, 57, 30, 63, 42, 74, 58, 44, 55.

Solution

$n = 50$

mean, $\bar{x} = \Sigma x/n = 53.14$.

x_i	$(x_i - \bar{x})^2$
45	66.2596
59	34.3396
32	446.8996
51	4.5796
56	8.1796
60	47.0596
51	4.5796
49	17.1396
25	791.8596
42	124.0996
54	0.7396
54	0.7396
58	23.6196
70	284.2596
43	102.8196
58	23.6196

x_i	$(x_i - \bar{x})^2$
50	9.8596
52	1.2996
38	229.2196
67	192.0996
50	9.8596
59	34.3396
48	26.4196
65	140.6596
71	318.9796
30	535.4596
46	50.9796
55	3.4596
82	832.8996
51	4.5796
63	97.2196
45	66.2596

x	$(x_i - \bar{x})^2$
53	0.0196
40	172.6596
36	293.7796
56	8.1796
70	284.2596
56	8.1796
70	284.2596
52	1.2996
67	192.0996
55	3.4596
57	14.8996
30	535.4596
63	97.2196
42	124.0996
74	935.1396
58	23.6196
44	83.5396
55	3.4596

Standard deviation, $SD = \sqrt{1/n \sum (x_i - \bar{x})^2}$

$= 12.18$

variance, $V(x) = 1/n \sum (x_i - \bar{x})^2$

$= 148.42$

Range = max value - min value

$= 82 - 25$

$= 57$

Program

```
x <- c(56.6,56.1,61.8,55.9,51.4,59.9,54.3,64.8,58.5,55.8,
       58.3,60.2,54.2,50.1,57.1,57.5,63.6,59.3,60.8,61.81,43.5,
       51.21,46.2,56.7,52.5,53.5,60.5,52.1,47,53); x
mean <- mean(x); mean
n <- length(x)
y <- abs(x-mean); y
md <- sum(y)/n ; md
q1 <- 52.5 ; q1
q3 <- 59.9 ; q3
qd <- (q3-q1)/2 ; qd
```

Output

```
mean = 55.82323
meandeviation = 4.698157
quartile deviation = 3.7
```

a) find the mean deviation about mean and quartile deviation of

55.6, 56.1, 61.8, 55.9, 51.4, 59.9, 54.3, 64.8, 58.5, 55.8, 58.3, 60.2, 54.2, 50.1, 57.1, 57.5, 63.6, 59.3, 60.9, 61.81, 43.5, 51.21, 46.2, 56.7, 52.5, 53.5, 60.5, 52.1, 47, 53

Solution

$n = 31$

$\bar{x} = \Sigma x_i / n$

$= 55.8$

x_i	$\lvert x_i - \bar{x} \rvert$
56.6	0.2
56.1	0.3
61.8	6.0
55.9	0.1
51.4	4.4
59.9	4.1
54.3	1.5
64.8	9.0
58.5	2.7
55.8	0.3
58.3	2.5
60.2	4.4
54.2	1.6
50.1	5.7
57.1	1.7
57.5	1.3
63.6	1.7
59.3	7.8

x_i	$\lvert x_i - \bar{x} \rvert$
60.9	5.1
61.81	6.01
43.5	12.3
46.2	9.6
56.7	0.9
52.5	3.3
53.5	2.3
60.5	4.7
52.1	3.7
47	8.8
53	2.8
51.21	4.59

Mean deviation $= \frac{1}{n} \Sigma |x_i - \bar{x}|$

$= 4.6$

$Q_1 = \left(\frac{n+1}{4}\right)^{th}$ observation

$= 52.5.$

$Q_3 = 3\left(\frac{n+1}{4}\right)^{th}$ observation

$= 59.9.$

Quartile deviation $= \frac{Q_3 - Q_1}{2} = \frac{59.9 - 52.5}{2} = 3.7.$

program

```
x <- 10:14; x
f <- c(3,12,13,12,8); f
cf <- cumsum(f); cf
N <- sum(f); N
q1-pos <- N/4; q1-pos
q3-pos <- 3*N/4; q3-pos
q1 <- min(which(cf >= q1-pos)); q1
q3 <- min(which(cf >= q3-pos)); q3
Q1 <- x[q1]; Q1
Q3 <- x[q3]; Q3
QD <- (Q3-Q1)/2; QD
```

output

Q1 = 11

Q3 = 13

Quartile deviation = 1

3, Find the quartile deviation for the data.

value	10	11	12	13	14
f	3	12	13	12	8

Solution:

x	f	cf
10	3	3
11	12	15
12	13	28
13	12	40
14	8	48

$Q_1 = (N/4)^{th}$ value.

$= 12^{th}$ value.

$= 11$.

$Q_3 = 3(N/4)^{th}$ value

$= 36^{th}$ value..

$= 13$

Quartile deviation $= \frac{Q_3 - Q_1}{2} = 1$

Program

```
x <- c(72,74,40,60,82,115,41,61,65,83,53,110,46,84,50,
       67,78,79,56,66,68,69,104,80,79,79,52,73,59,
       81,66,49,77,90,84,76,42,64,64,70,72,50,79,
       79,52,105,96,51,86,78,94); x
m <- mean(x); x
var <- var(x); var
sd <- sqrt(var); sd
cv <- (sd/m) * 100; cv
```

output

mean = 71.4

variance = 318.4082

standard deviation = 17.844

coefficient of variation = 24.99159

4) Obtain the coefficient of variation of the data

72, 74, 40, 60, 82, 115, 41, 61, 65, 83, 53, 110, 46, 84, 50, 67, 78, 79, 56, 65, 68, 69, 104, 80, 79, 79, 52, 73, 59, 81, 66, 49, 77, 90, 84, 76, 42, 64, 64, 70, 72, 50, 79, 79, 52, 105, 96, 51, 86, 78, 94

Sol) $n = 50$

$\bar{x} = \Sigma x / n = 71.4$

x_i	$(x_i - \bar{x})^2$
72	0.36
74	6.74
40	985.96
60	129.96
82	112.36
115	1900.96
41	924.16
61	108.16
65	40.96
83	134.56
53	338.56
110	1489.96
46	645.16
84	158.76
50	457.96
67	19.36
78	43.56

x_i	$(x_i - \bar{x})^2$
79	57.76
56	237.16
65	40.96
68	11.56
69	5.76
104	1062.76
80	73.96
79	57.76
79	57.76
52	374.36
73	2.56
59	153.76
81	92.16
66	29.16
49	501.76
77	31.36
90	345.96

x_i	$(x_i - \bar{x})^2$
84	158.76
76	21.16
42	864.36
64	54.76
64	54.76
70	1.96
72	0.36
50	457.96
79	57.76
79	57.76
52	376.76
105	1128.96
96	605.16
51	416.16
86	213.16
78	43.56
94	510.76

variance $= \frac{1}{n} \Sigma (x - \bar{x})^2$

$= 312.46$

standard variance $(\sigma) = \sqrt{\frac{1}{n} \Sigma (x - \bar{x})^2}$

$= 17.676$

coefficient of variation $= \frac{\sigma}{\bar{x}} \times 100 = 24.75$

6. Find the standard deviation, quartile deviation, mean deviation about mean & coefficient of variation for the data

class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
f	5	8	22	27	17	9	5	5	2	9

solution >

$N = \Sigma fi = 109$.

class	midx	fi	fi·midx	cf	f(midx)^2	|midx − 42.43| fi
0-10	5	5	25	5	125	187.15
10-20	15	8	120	13	1800	219.44
20-30	25	22	550	35	13750	383.46
30-40	35	27	945	62	33075	200.61
40-50	45	17	765	79	34425	43.69
50-60	55	9	495	88	27225	113.13
60-70	65	5	325	93	21125	112.85
70-80	75	5	375	98	28125	165.85
80-90	85	2	170	100	14450	85.14
90-100	95	9	855	109	81225	473.13

$$\text{Mean} = \frac{\Sigma xf}{N}$$

$$= 42.43$$

$$\text{variance} = \frac{1}{N}\Sigma x_i^2 fi - (42.43)^2 = 542.03$$

$$\text{standard deviation} = \sqrt{\text{variance}} = 23.28$$

$$Q_1 = l_1 + \left(\frac{N/4 - cf_1}{f_1}\right) \cdot h$$

$$= 26.48$$

$$Q_3 = l_3 + \left(\frac{3N/4 - cf_3}{f_3}\right) \cdot h$$

$$= 53.06$$

Quartile deviation $= \frac{Q_3 - Q_1}{2}$

$$= 13.29$$

Mean deviation about mean $= \frac{\Sigma f_i |x_i - \bar{x}|}{N}$

$$= \frac{1981.45}{109}$$

$$= 18.178$$

coefficient of variation $= \frac{SD}{\bar{x}} \times 100$

$$= 54.87$$

Program

```
x<-c(78,29,32,80,100);x
y<-c(100,80,72,100,75);y
cv1<-(sd(x)/mean(x))*100;cv1
cv2<-(sd(y)/mean(y))*100;cv2.
```

Output

```
mean of x = 63.8
coefficient of variation of x = 49.54565
mean of y = 85.4
coefficient of variation of y = 15.96118
```

7. The scores of a batsman in different matches are given below, find who is more consistant

Batsman A	78	29	32	80	100
Batsman B	100	80	72	100	75

solution >

$\bar{x} = \Sigma x/n = 63.8$

$\bar{y} = \Sigma y/n = 85.4.$

x	$(x_i - \bar{x})^2$	y	$(y_i - \bar{y})^2$
78	201.64	100	213.16
29	1211.04	80	29.16
32	1011.24	72	179.56
80	262.44	100	213.16
100	1310.44	75	108.16

$\sigma x = \sqrt{\frac{1}{(n-1)} \Sigma (x_i - \bar{x})^2} = 31.7$

$\sigma y = \sqrt{\frac{1}{(n-1)} \Sigma (y_i - \bar{y})^2} = 13.63$

$Cvx = \frac{\sigma x}{\bar{x}} \times 100 = 49.545$

$Cvy = \frac{\sigma y}{\bar{y}} \times 100 = 15.96$