

Program

```
x <- c(15, 45, 40, 42, 50, 60, 62, 68, 70, 42, 75, 75, 80, 81, 25, 26, 31, 32, 78, 45, 31, 45, 42,  
43, 55, 56, 78); x  
mean <- sum(x) / length(x); mean  
logx <- log(x, 10); logx  
loggm <- sum(logx) / length(x); loggm  
gm <- 10^loggm; gm  
y <- 1/x; y  
hm <- length(x) / sum(y); hm
```

Output

mean = 51.55556

gm = 47.71364

hm = 43.39266

PRACTICAL SHEET - 2

MEASURES OF CENTRAL TENDENCY

1. Calculate arithmetic mean, geometric mean, and harmonic mean.

15, 45, 40, 42, 50, 60, 62, 68, 70, 42, 75, 75, 80, 81, 25, 26, 31, 32, 78, 45, 31, 45, 42, 43, 55, 56, 78

Solution:

$$n = 27$$

$$\text{Mean}, \bar{x} = \frac{\sum x_i}{n}$$

$$= 51.556$$

x	$\log x$	$1/x$
15	1.1761	0.0667
45	1.6532	0.0222
40	1.6021	0.025
42	1.6232	0.0238
50	1.6990	0.02
60	1.7782	0.0167
62	1.7924	0.0161
68	1.8325	0.0147
70	1.8451	0.0143

x	$\log x$	$1/x$
42	1.6232	0.0238
75	1.8751	0.0133
75	1.8751	0.0133
80	1.9031	0.0125
81	1.9085	0.0123
25	1.3979	0.04
26	1.4150	0.0384
31	1.4914	0.0322
32	1.5051	0.0313

x	$\log x$	$1/x$
78	1.8921	0.0128
45	1.6532	0.0222
31	1.4914	0.0322
45	1.6532	0.0222
42	1.6232	0.0238
43	1.6335	0.0233
55	1.7404	0.0182
56	1.7482	0.0179
78	1.8921	0.0128

Geometric mean, G.M = $\text{antilog}(\frac{\sum \log x}{n})$

$$= 47.71$$

Harmonic mean, H.M = $\frac{n}{\sum 1/x}$

$$= 43.393$$

Program

```
x <- c(45, 50, 55, 60, 65, 70, 75, 80); x  
f <- c(3, 5, 8, 7, 9, 7, 4, 7); f  
N <- sum(f); N  
mean <- sum(x*f)/N; mean  
logx <- log(x, 10); logx  
flogx <- f*logx; flogx  
loggm <- sum(flogx)/N; loggm  
gm <- 10^loggm; gm  
fbyx <- (1/x)*f; fbyx  
hm <- N/sum(fbyx); hm
```

Output

mean = 63.6

gm = 62.7429

hm = 61.87485

2. The annual salaries of a group of employees are given in the following table.

Salaries (in 1000's)	45	50	55	60	65	70	75	80
No. of persons	3	5	8	7	9	7	4	7

Calculate the mean, G.M and H.M.

Solution:

x_i	f_i	$x_i f_i$	$\log x_i$	$1/x_i$	$f_i \log x_i$	f_i / x_i
45	3	135	1.6532	0.0222	4.9596	0.0666
50	5	250	1.6990	0.02	8.4949	0.1
55	8	440	1.7404	0.0182	13.9229	0.1455
60	7	420	1.7782	0.0167	12.4471	0.1167
65	9	585	1.8129	0.0154	16.3162	0.1385
70	7	490	1.8451	0.0143	12.9157	0.1
75	4	300	1.8751	0.0133	7.5002	0.0533
80	7	560	1.9031	0.0125	13.3216	0.0875

$$N = 50$$

$$\text{Mean} = \frac{\sum x_i f_i}{N}$$

$$= 63.6$$

$$\text{Geometric Mean, G.M} = \text{antilog} \left(\frac{\sum f_i \log x_i}{N} \right)$$

$$= 62.74$$

$$\text{Harmonic Mean, H.M} = \frac{N}{\sum f_i / x_i}$$

$$= 61.87$$

Program

```
x <- 0:4 ; x  
f <- c(19, 18, 8, 4, 1) ; f  
z <- rep(x, f) ; z  
median(z)
```

Output

Median = 1

3XBHD00035

3. Find the median for the data

x	0	1	2	3	4
f	19	18	8	4	1

Solution:

x_i	f_i	Cumulative Frequency
0	19	19
1	18	37
2	8	45
3	4	49
4	1	50

$$N=50$$

Median = observation at $(\frac{N+1}{2})^{\text{th}}$ position

$$= \underline{1}$$

Program

```
x <- c(72, 74, 40, 60, 82, 115, 41, 61, 65, 83, 53, 110, 46, 84, 50, 67, 78, 79, 56, 65, 68,  
69, 104, 73, 59, 81, 66, 49, 77, 90, 84, 76, 64, 64, 70, 72, 50, 79, 50, 79, 52, 103, 96,  
51, 86, 78, 94, 80, 79, 74, 52); x
```

```
xt <- table(x); xt
```

```
which(xt == max(xt))
```

Output

Mode = 79

4. Calculate the mode.

72, 74, 40, 60, 82, 115, 41, 61, 65, 83, 53, 110, 46, 84, 50, 67, 78, 79, 56, 65, 68, 69, 104,
73, 59, 81, 66, 49, 77, 90, 84, 76, 64, 64, 70, 72, 50, 79, 50, 79, 52, 103, 96, 51, 86,
78, 94, 80, 79, 74, 52.

Solution:

Mode is the value that occurs maximum no. of times.

$$\therefore \text{Mode} = 79$$

Program

```
midx <- seq(from = 147.5, to = 182.5, by = 5); midx  
f <- c(4, 6, 28, 58, 64, 30, 5, 5); f  
N <- sum(f); N  
mean <- sum(midx*f)/N; mean  
h <- 5; h  
cumfreq <- cumsum(f); cumfreq  
df <- data.frame(midx, f, cumfreq); df  
medsno <- min(which(cumfreq >= N/2)); medsno # serial no. of median class  
l <- midx[medsno] - (h/2); l  
cf <- cumfreq[medsno-1]; cf # cum. frequency of preceding class  
f1 <- f[medsno]; f1  
median <- l + ((N/2 - cf)/f1)*h; median  
modclass <- which(f == max(f)); modclass # serial no. of modal class  
fmod <- f[modclass]; fmod  
f0 <- f[modclass-1]; f0  
f2 <- f[modclass+1]; f2  
mode <- l + (fmod - f0)/(2*fmod - f0 - f2)*h; mode
```

Output

Mean = 165.175

Median = 165.3125

Mode = 165.75

Model class : 165 - 170

$\rho_1 = 64$, $\rho_0 = 58$, $\rho_2 = 30$

Mode = 165.75

5. Compute the mean, median and mode for the following data.

Class	145-150	150-155	155-160	160-165	165-170	170-175	175-180
f	4	6	28	58	64	30	5
180-185							
5							

Solution:

class	x_i	f_i	$x_i f_i$	cum. freq
145-150	147.5	4	590	4
150-155	152.5	6	915	10
155-160	157.5	28	4410	38
160-165	162.5	58	9425	96
165-170	167.5	64	10720	160
170-175	172.5	30	5175	190
175-180	177.5	5	887.5	195
180-185	182.5	5	912.5	200
			33035	

$$\text{Mean}, \bar{x} = \frac{\sum x_i f_i}{N}$$

$$= 165.175$$

=

$$\text{Median} = d + \left(\frac{N/2 - cf}{f} \right) h$$

Median class : 165-170

$$\therefore d = 165, cf = 96, f = 64, h = 5$$

$$\therefore \text{Median} = 165.3125$$

=

$$\text{Mode} = d + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) h$$