Practical No : 1

Basic of R software :-

1) R is a software for data analysis and statistical computing.

2) It is a software by which effective data handling and outcome storage is possible.

3) It is capable of graphical display.

4) It is a free software.

1) $2^2 + |-5| + (4 \times 5) + (6 \div 5)$

2^2 + abs(-5) + 4*5 + 6/5

[1] 30.2

2) $x = 20,\ y = 2x,\ z = x + y,\ \sqrt{z}$

x = 20

y = 2*x

z = x+y

sqrt (z)

[1] 7.749

3) $x = 10,\ y = 15,\ z = 5$

(a) $x+y+z$ b) xyz (c) $\sqrt{xy^2}$ (d) round $(\sqrt{xyz})$

\> x = 10

\> y = 15

\> x + y + z

[1] 30

-> sqrt (x) y x)
[1] 2.7 55 6 13
-> round (sqrt (x y z))
[1] 27

Vectors in R software is denoted by the syntax (c)

1) (2, 3, 5, 7) ÷ 2
> x = c(2, 3, 5, 7)
> x ^ 2
[1] 4 9 25 49

2) c(2, 3, 5, 7) ^ c(2, 3)

> a = c(2, 3, 5, 7)
> b = c(2, 3)
> a ^ b
[1] 4 27 25 49

3) c(2, 3, 5, 7, 9, 11) ^ c(2, 3)
> a = c(2, 3, 5, 7, 9, 11)
> b = c(2, 3)
> a ^ b
[1] 4 27 25 343 81 1331

4) c(1, 2, 3, 4, 5, 6) ^ c(2, 3, 4)
> a = c(1, 2, 3, 4, 5, 6)
> b = c (2, 3, 4)
> a ^ b

[1] 1 8 81 16 125 1296
5) c(3, 5, 7, 9, 11) × 3
> a = c(3, 5, 7, 9, 11)
> a × 3
[1] 6 15 21 27

Or c(2, 5, 3, 7) × 3
[1] 6 15 21 27

6) c(2, 3, 5, 7) × c(-2, -3, -5, -7)
-> c(2, 3, 5, 7) × c(-2, -3, -5, -7)
[1] -4 -9 -25 -49

7) c(5, 6, 7, 8) + 10
-> c(5, 6, 7, 8) + 10
[1] 15 16 17 18

8) c(5, 6, 7, 8) + c(-2, -3, -1, 0)
-> c(5, 6, 7, 8) + c(-2, -3, -1, 0)
[1] 3 3 6 8

9) c(2, 3, 5, 7) ÷ 2
> c(2, 3, 5, 7) / 2
[1] 1.0 1.5 2.5 3.5

Sum, Product

Q. Find the sum, product root for the following values
4, 9, 2, 5, 7, 8, 3, 6, 15, 12, 10, 9, 8, 13, 14

-> x = c(4, 9, 2 ... 14)
> length (x)
[1] 15
> y = sum (x)
> y
[1] 125
> b = prod (x)
> b
[1] 8.55932

P.D.

Q. Find sum, product, square root, maximum and minimum values in the following

> x = c(2, 8, 9, 11, 10, 7, 6)^2

> x

[1] 4 64 81 121 100 49 36

> sum (x)

[1] 455

> prod (x)

[1] 6425 . . 00

> max (x)

[1] 121

> min (x)

[1] 4

matrix

Q. $\begin{bmatrix} 1 & 5 \\ 2 & 6 \\ 3 & 7 \\ 4 & 8 \end{bmatrix}$

-> x <- matrix (nrow =4, ncol = 2, data = c(1,2,3,4, 5,6,7,8)

-> x

	[,1]	[,2]
[1,]	1	5
[2,]	2	6
[3,]	3	7
[4,]	4	8

Q. $X = \begin{bmatrix} 4 & 7 & 8 \\ 5 & 8 & 0 \\ 6 & 9 & 2 \end{bmatrix}$ $Y = \begin{bmatrix} 6 & 11 & 9 \\ 4 & 12 & 7 \\ 5 & 8 & 4 \end{bmatrix}$

a) x+y b) x×2 c) y * 3, d) x<y

-> > x <- matrix (nrow = 3, ncol=3, data = c(4, 5,6, 7, 8, 9, 4, 0, 2))

> y <- matrix (nrow = 3, ncol = 3, data = c(6, 4, 5, 11, 12, 8, 9, 9, 7, 4))

> x

	[1]	[2]	[3]
[1]	4	7	8
[2]	5	8	0
[3]	6	9	2

> y

	[,1]	[,2]	[,3]
[1,]	6	11	9
[2,]	4	12	7
[3,]	5	8	4

> x+y

	[,1]	[,2]	[,3]
[1,]	10	18	13
[2,]	9	20	7
[3,]	11	17	6

> x × 2

	[,1]	[,2]	[,3]
[1,]	8	14	8
[2,]	10	16	10
[3,]	12	18	4

> y α 3

	[,1]	[,2]	[,3]
[1,]	18	33	27
[2,]	12	36	21
[3,]	15	24	12

> x * y

	[,1]	[,2]	[,3]
[1,]	24	77	36
[2,]	20	96	0
[3,]	30	72	8

Practical No. 2

Binomial distribution

n = Total no. of trials

p = p(success)

q = p(failure)

x = No. of success of n

$p(x) = {}^nC_x \, p^x \cdot q^{n-x}$

$E(x) = np$ $\quad$ $V(x) = npq$.

Q.1 Toss a coin 10 times with $P(H) = 0.6$ let x be the no. of heads. Find the probability of
1. 7 heads
2. 4 heads
3. At most 4 heads
4. At least six heads
5. No heads
6. All heads

Also find Exceptions and variance.

→ > n = 10

> p = 0.6

> q = 0.4

> dbinom(7, 10, 0.6)

[1] 0.2149908

> dbinom(4, 10, 0.6)

> pbinom(4, 10, 0.6)

[1] 0.1662386

> 1 - pbinom(6, 10, 0.6)

[1] 0.3822806

> dbinom(0, 10, 0.6)

[1] 0.0001048576

> dbinom(10, 10, 0.6)

[1] 0.0000046618

> E = n × p

> E

[1] 6

> V = n p q

V

[1] 4

Q. Suppose there are 12 MCQS in an English Question paper last question have five answers only one of the is correct. Find the probability (1) 4 correct answer (2) Atmost 4 correct answer (3) Atleast 3 correct answer

Q. 3) Find the complete binomial distribution when n = 5 and p = 0.1

Q. 4) Find the probability of exactly 10 success out of 100 trials with p = 0.1

Q. 5) X follows binomial distribution with n = 17 and p = 0.25 find
i) $P(x \le 5)$ (2) $P(x > 7)$ iii) $P(5 < x < 7)$

Q. 6) There are 10 members in a committee probability of any member attending a meeting is 0.9 what is probability or more members will be present in a committee.

Note :-

1) $P(X = x)$ = dbinom (x, n, p)

(2) probability of atmost x values
$P(x \le x)$ = pbinom (x, n, p)

(3) probability of at least x values
$p(x > x)$ = 1 - pbinom (x, n, p)

(4) If x is unknown and the probability is given as P_1, to find x :
P_1 qbinom (p, n, p)

Q.1) n = 12 p = 1/5

(1) P(x > = 4)

-> > d binom (4, 12, 1/5)
[1] 0.1328756

> binom (4, n, p)
[1] 0.9274475

> 1 - pbinom (x, n, p)
[1] 0.4416543

Q.3) n = 5
p = 0.1

> dbinom (0, n, p)
[1] 0.59049

> dbinom (1, n, p)
[1] 0.32805

> dbinom (2, n, p)
[1] 0.0729

> dbinom (3, n, p)
[1] 0.0045

```
> d binom (4,n,p)
[1] 0.0081
> d binom (5,n,p)
[1] 10.05
```

6

Q.4)
```
> p = 0.1
> x = 10
> n = 100
> d binom (x,n,p)
  [1] 0.1318653
```

Q.5)
```
n =12
p =0.25
> p binom (3,n,p)
  [1] 0.9455978
  > 1- pbinom (7,n,p)
    [1] 0.00278
  > dbinom (6,n,p)
  [1] 0.040 14945
```

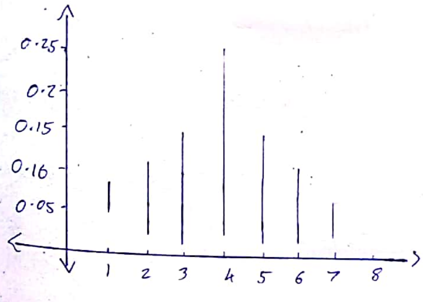
Q.6)
```
n= 10
p = 0.9
> 1- p binom (6,n,p)
  [1] 0.9872 048
```

Q.7)
```
p = 0.2
n = 30
q = binom (0.88, n,p)
[1] 9
```


Q.8
```
>n = 10
>p = 0.6
>x = 0:n
>bp = d binom (x,n,p)
>d = data.frame ("X values"=x, "probablity"=bp)
>print (d)
```

	x values	X values	probablity
1	0	0	0.0001048576
2	1	1	0.0015728640
3	2	2	0.0106168 3
4	3	3	0.04246732
5	4	4	0.1114767 3280
6	5	5	0.2006581248
7	6	6	0. 2508 225560
8	7	7	0.1209323 520
9	8	8	0.D403107840
10	9	9	0.0060466176
	10	10	

```
> plot (x, bp, "h")
```



Pmf (Probablity mass function)

```
> x
[1] 0 1 2 3 4 5 6 7 8 9 10
> n
[1] 10
> p
[1] 0.6
> cp = pbinom(x, n, p)
> plot(x, cp, "s")
```

PRACTICAL NO. 3

Q. check the following of are pmf (probability mass function) or not.

Q (i)

x	1	2	3	4	5
$p(x)$	0.2	0.5	-0.5	0.4	0.4

sol :-

p(x) = 1.0

> prob = c (0.2 , 0.5, -0.5 , 0.4 , 0.4)

sum (prob)

[1] 1.0

p(x) = 0

According to the condition :

i) $0 \leq p(x) \leq 1$

ii) $\Sigma\, p(x) = 1$

p(x) cannot be less than 1

∴ Not a pmf

ii)

x	10	20	30	40	50
$p(x)$	0.3	0.2	0.3	0.1	0.1

Sol:- prob = c (0.3, 0.2, 0.3 , 0.1 , 0.1)

sum (prob)

[1] 1.0

As the statement satisfying both condition

∴ It is probability mass function (pmf)

iii)

x	0	1	2	3	4
$p(x)$	0.4	0.2	0.3	0.2	0.1

soln :-

The condition to check pmf

$0 \leq p(x) \leq 1$ — ①

$\Sigma\, p(x) = 1$ — ②

> prob = c (0.4, 0.2 , 0.3, 0.2, 0.01)

> sum = (prob)

[1] 1.2

Here , as the second condition is not satisfied it is not a pmf.

Q] following is a pmf of x. Find mean and variance of x

x	1	2	3	4	5
$p(x)$	0.1	0.15	0.2	0.3	0.25

x	$p(x)$	$x\,p(x)$	$x^2(p(x))$
1	0.1	0.1	0.1
2	0.15	0.3	0.6
3	0.2	0.6	1.8
4	0.3	1.2	4.8
5	0.25	1.25	0.25
		$\Sigma x p x = 3.45$	$\Sigma x^2 p x = 13.55$

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mean $= E(x) = \Sigma x\, f(x) = 3.45$

Var $= V(x) = \Sigma x^2 f(x) - [E(x)]^2$

$= 13.55 - (3.45)^2$

$= 1.6475$

Using R

```
> x = c[1, 2, 3, 4, 5]
> prob = (0.1, 0.15, 0.2, 0.3, 0.25)
> a = x prob
> mean = sum(a)
> mean
>[1] 3.45
> b = (x^2) * prob
> var = (sum(b) - mean'2
> var
[1] 1.6475
```


Q.3 Following is a pmf of X. Find mean and variance

x	5	10	15	20	25
$f(x)$	0.1	0.3	0.2	0.25	0.15

Soln :-

```
> a = c(5, 10, 15, 20, 25)
> prob = c(0.1, 0.3, 0.2, 0.25, 0.19)
> x = a* prob
> x
[1] 0.500 3.00 3.0 5.0 3.45
> mean = sum(x)
> mean
[1] 15.25
> b = (a^2)* prob
> var = sum(b) - mean^2
> var
[1] 39.6875
```

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PRACTICAL - 4

$P(X=x) = \binom{n}{x} p^x q^{n-x}$

① $P(X=7) = \binom{8}{7} (0.6)^7 (0.4)^{8-7}$

$= {}^8C_7 \times 0.2799 \times 0.4$

$= 8 \times 0.2799 \times 0.4$

$= 0.08957$

② $P(X \le 3) = P(0) + P(1) + P(2) + P(3)$

$= {}^8C_0 (0.6)^0 (0.4)^8 + {}^8C_1 (0.6)^1 (0.4)^7$

$+ {}^8C_2 (0.6)^2 (0.4)^6 + {}^8C_3 (0.6)^3 (0.$

$= 1 \times 1 \times 0.00065536 \times 8 \times 0.6 \times$

$0.0016384 \quad 482 \times 0.36 \times 0.0040$

$+ 56 \times 0.216 \times 0.01024$

$= 0.1736704$

③ $P(X = 2 \ge 3) = P(2) + P(3)$

$= {}^8C_2 (0.6)^2 (0.4)^6 + {}^8C_3 (0.6)^3 ($

$= 28 \times 0.36 \times 0.004096 + 56 \times$

0.216×0.001024

$= 0.04128768 + 0.1238304$

$= 0.16515012$

Scanned with CamScanner

PRACTICAL - 5

1) Normal Distribution:

Normal distribution is example of continuous probability distribution

$x \sim N(\mu, \sigma^2)$

i) $P(X = x)$ = dnorm (x, μ, σ)

ii) $P(X \leq x)$ = pnorm (x, μ, σ)

iii) $P(x > x)$ = 1 - pnorm (x, μ, σ)

iv) To find the value of K so that find the command is qnorm (p, μ, σ)

K $P(x \leq K) = p$

qnorm (p, μ, σ)

v) To generate a random sample of size n

rnorm (n, μ, σ)

Q.1 A random variable X follows normall Distribution with $\mu = 10$, $\sigma = 2$

Find: (i) $P(x \leq 7)$

(ii) $P(x > 12)$

(iii) $P(5 < x \leq 12)$

(iv) $P(x < K) = 0.4$

Q.2

$x \sim N(100, 36)$

σ = sqrt (36) :

(i) $P(x \leq 110)$ ii) $P(x > 105)$ iii) $P(x \leq 92)$

iv) $P(95 \leq x \leq 110)$ v) $P(x \leq K) = 0.9$

Q.3 $x \sim N(10, 3)$
Generate 10 random sample and find the sample mean, median, variance and standard deviation.

Q.1 Soln:

```
> u = 10
> s = 2
> P1 = pnorm (7, u, s)
> cat ("P(x ≤ 7) is =", P1)
[1] P(x ≤ 7) is = 0.0668072
> p2 = 1 - pnorm (12, u, s)
> cat ("p (x > 12) is =", p2)
[1] P(x > 12) is = 0.158655
> P3 = pnorm (12, u, s) - pnorm (5, u, s)
> cat ("P (5 ≤ x ≤ 12) is =", P3)
[1] P(5 ≤ x ≤ 12) is = 0.8351351
> K = qnorm (0.4, u, s)
> cat ("P (x, K) is =", K)
P(x < K) is = 9.493306
```


Q.2 Soln :-

```
> u = 100
> s = sqrt (36)
> s
[1] 6
> P1 = pnorm (110, u, s)
> P1
> cat ("P(x ≤ 110 ) is =", P1)
[1] P(x <= 110) is = 0.952096
> P2 = 1 - pnorm (105, u, s)
> cat ("P (x > 105) is =", P2)
[1] P(x > 105 ) is = 0.203284
> P3 = pnorm (92, u, s)
> cat ("P (x <= 92) is =", P3)
[1] P(x <= 92 ) is = 0.0912122
> P4 = pnorm (110, u, s) - pnorm (95, u, s)
> cat ( "P (95 < x < 110) is =", P4)
P(95 < x < 110) is = 0.7498813
> K = qnorm (0.9, u, s)
> cat ("P (x < K) is = ", K)
P (x < K) is = 107.6893
```

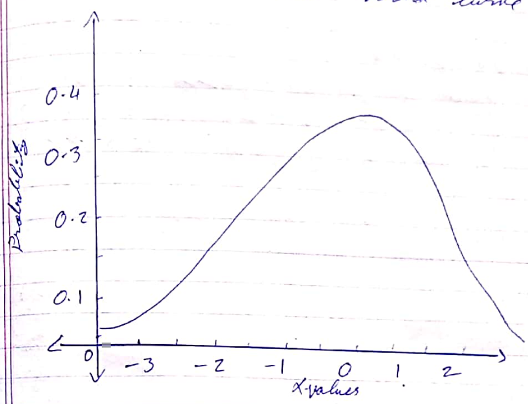
Q.3 Soln

```
> u = 10
> s = 3
> n = 10
> x = prnorm (10, 10, 3)
> x
> n = mean (x)
> n
 [1] 9.89762
> m = median (x)
> m
 [1] 10.59762
> v = (n-1) (var(x)/n)
> v
 [1] 7.636718
> sd = sqrt (v)
> sd
 [1] 2.3461
```

Q.4 plot the standard normal curve

```
> x = seq (-3, 3, by 0.1)
> y = dnorm (x)
> y
> plot (x, y , xlab = "x value", xlab = "probability",
      main = "standard normal curve")
```


Standard Normal curve



Q.5 x ~ n (50, 100)

Find (i) P(x ≤ 60)

(ii) P(x > 65)

(iii) P(45 ≤ x ≤ 60)

Soln :-

```
> v = 50
> s = sqrt (100)
> s
 [1] 10

> P1 = pnorm (60, u, s)
> P1
 [1] 0.8413447
```

```
> p3 = 1 - pnorm (65, m, s)
> p3
[1] 0.0665077
> p3 = pnorm (60, m, s) - pnorm (65, m, s)
> cat ("P (65, <= x <= 65 is = ", p3)
[1] P (56 <= x <= 65) is = 0.5328072
```

Practical No. 6

Topic : Z and t distribution sums

Q.1) Test the hypothesis $H_0 : \mu = 20$ against $H_1 : \mu \neq 20$ a sample of size 400 is selected and the sample mean is 20.2 and a standard deviation 2.25. Test that 5% level of significance

```
> m0 = 20
> mx = 20.2
> sd = 2.25
> n = 400
> zcal = (mx - m0)/(sd/sqrt(n))
> zcal
[1] 1.777778
> cat(" z calculated is : ", zcal)
z calculated is = 1.77777787
> pvalue = 2* (1-pnorm (abs (zcal)))
> pvalue
[1] 0.07544036
```

Since pvalue is more than 0.05 we accept $H_0 : \mu = 20$

Q.2) We want to test the hypothesis $H_0 : \mu = 250$ against $H_1 : \mu \neq 250$ a sample of size 100 has a mean of 275 and sd 30. Test the hypothesis at 5% level of significance

```
> m0 = 250
> mx = 275
> sd = 30
> n = 100
> zcal = (mx - m0))/(sd/sqrt(n))
> zcal
[1] 8.333333
> cat ("z calculate is = ", zcal)
> z calculated is 8.333333
```

```
> p value = 2 * (1-pnorm (abs (zcal)))
> p value
[1] 0
```

since pvalue is less than 0.05 we reject H0.

Q-3 we want to test the hypothesis H0 : p = 0.2 against H1 : p ≠ 0.2 (p = population proportion). A sample of 400 is selected and the sample proportion is calculated 0.125. Test the hypothesis at 1% level of significance.

```
> p = 0.2
> Q = 1-p
> n = 400
> zcal = (P-p) / sqrt(p*Q/n))
> zcal
[1] -3.75
> pvalue = 2 * (1-pnorm (abs(z cal)))
> pvalue
[1] 0.0001768346
```

since pvalue is less than 0.05 we reject null.

Q-4) In a big city 325 men out of 1000 men that were found to be self employed thus this information support the conclusion that exactly that half of the men are self employed.

```
> p = 0.5
> n = 1000
> P = 325/600
> Q = 1-p
> zcal = (P-p) / sqrt (p*Q/n))
> zcal
2.3204241
```



```
> p value = 2 * (1-pnorm (abs (zcal)))
> pvalue
[1] 0.04122683
```

since pvalue is less than 0.05 we reject H0.

PRACTICAL NO. 7

Topic : large sample test

Q.1 If two random sample of sizes 1000 and 2000 are drawn from two population in the standard deviation 2 and 3 respectively. Test the hypothesis that the two population mean are equal or not at 5% level of significance. The sample means are 67 and 68 respectively.

```
> n1 = 1000
> n2 = 2000
> mx1 = 67
  mx2 = 68
> sd1 = 2
> sd2 = 3
> z cal = (mx1 - mx2) / sqrt((sd1^2 / n1) +
                              (sd2^2 / n2))
> cat(" z calculated is=" zcal)
  z calculated is -10.84652
> pvalue = 2 * (1-pnorm (abs (zcal)))
> pvalue
   [1] 0
```

Since pvalue is less than 0.05, we reject $H_0: \mu_1 = \mu_2$

```
-> > ny = 84
 > nz = 34
 > mx = 61.2
 > mx2 = 59.4
 > sd1 = 7.9
 sd2 = 7.8
 > zcal = (mx1 - mx2) / sqrt((sd1^2/n1
> zcal
 [1] 1.131117
```

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> cat ("z calculated is =", zcal)
z calculated is = 1.13117