Practical No. 1

Basics of R software

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

2) This software is used for affective data handling ad output storage is possible

3) It is capable of graphical display

4) It is a free software

Q1 $2^2 + \sqrt{25} + 35$

```
> (2**2) + sqrt(25) + 35
[1] 44
```

Q2 $2 \times 5 \times 3 + 62 \div 5 + \sqrt{49}$

```
> 2*5*3 + (62/5) + sqrt(49)
: 49.4
```

Q3 $\sqrt{76 + 4 \times 2 + 9 \div 5}$

```
> sqrt(76 + (4 * 2) + (9/5)) = 9.262829
```

Q4 $42 + |-10| + 7^2 + 3 \times 9$

```
> 42 + abs(-10) + (7**2) + 3×9
= 128
```

Q2) $x = 20$

$y = 30$

find $x+y$; x^2+y^2 , $\sqrt{y^3-x^3}$, $|x-y|$

```
> x+y
  50
> (x ** 2) + (y ** 2)
  1300
> sqrt ((y ** 3) - (x ** 3))
  137.8405
> abs (x-y)
  10
```

Q3
```
c(2,3,4,5) ^2
  4  9  16  25

c (4,5,6,8) * 3
  12  15  18  24

c(2,3,5,7) * c(-2,-3,-5,-4)
  -4  -9  -25  -28

c (2,3,5,7) * c(8,9)
  16  27  40  63
```

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```
c(1,2,3,4,5) ^ c(2,3,4)
    Error

c(1,2,3,4,5,6) ^ c(2,3)
    1   8   9   64   25   216
```

1^2 2^3 3^2 4^3 5^2 6^3

Q4 find the sum, product, maximum, minimum of the values 5, 8, 6, 7, 9, 10, 15, 5

```
> x = c(5,8,6,7,9,10,15,5)
> length(x)
 8
> sum(x)
 65
> prod(x)
 11340000
> max(x)
 15
> min(x)
 5
> 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
```

Q6 $x = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$

$y = \begin{bmatrix} 2 & 4 & 10 \\ -2 & 8 & -11 \\ 10 & 6 & 12 \end{bmatrix}$

```
>x<-matrix (nrow=3, ncol=3, data= c(1,2,3,4,5,6,8,9)
>y<-matrix (nrow=3, ncol=3, data c(2,-2,10,4,6,16,10,
                                          -11,12)
```

```
> x+y
      [1]   [2]   [3]
[1]    3     8    17
[2]    0    13    -3
[3]   13    12    21
```

```
> x*y
      [1]   [2]   [3]
[1]    2    16    70
[2]   -4    40   -88
[3]   50    36   108
```

```
> x*2+y*3
      [1]   [2]   [3]
[1]    8    20    44
[2]   -2    34   -17
[3]   36    30    54
```

```
> x c( 2,4,6,1,3,5,7,18,16,14,17,19,3,3, 2,5,0,15,9,14,18
       10,12)
> length(x)
[1]  23
> a = table(x)
> a
x
0  1  2  3  4  5  6  7  8  10  12  14  15  16  17  18  19
1  1  2  3  1  2  1  1  1  1   1   2   1   1   1   2   1

> transform
[1]   x        freq
      0         1
      1         1
      2         2
      3         3
      4         1
      5         1
      6         2
      7         1
      9         1
      10        1
      12        1
      14        2
      15        1
      16        1
      17        1
      18        2
      19        1
```

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Practical No. 2

Pdf and cdf.

Can the following be p.d.f?

i) $f(x) = \begin{cases} 2-x & ; 1 \le x \le 2 \\ 0 & \text{o.w} \end{cases}$

$\Rightarrow \int_1^2 (2-x)\,dx$

$\Rightarrow \int_1^2 2dx - \int_1^2 x\,dx$

$= 2x \Big|_1^2 - \frac{x^2}{2} \Big|_1^2 xdx$

$= (4-2) - (2-0.5)$

$\neq 1$

Not a p.d.f

(ii) $f(x) = \begin{cases} 3x^2 & , 0 < x < 1 \\ 0 & \text{o.w} \end{cases}$

$\int_0^1 \frac{\cancel{3}x^3}{\cancel{3}}$

$= x^3 \Big|_0^1$

$= 1$

It is a p.d.f

(iii) $f(x) = \begin{cases} \frac{3x}{2}\left(1-\frac{x}{2}\right) ; & 0 \le x < 2 \\ 0 & , o.w \end{cases}$

[1

$$\int_0^3 \left(\frac{3x}{2} - \frac{3x^2}{4}\right) dx$$

$$= \frac{3}{2}\int_0^2 x\,dx - \frac{3}{4}\int_0^2 x^2\,dx$$

$$= \frac{3}{2}\left[\frac{x^2}{2}\right]_0^2 - \frac{1}{4}\left[x^3\right]_0^2$$

$$= \frac{3}{4}\left[x^2\right]_0^2 - \frac{1}{4}\left[x^3\right]^2$$

$$= \frac{3}{\cancel{4}}\left[\cancel{4}\right] - \frac{1}{4}\left[\cancel{8}^{2}\right]$$

$$= 1$$

It is a p.d.f

Q2 Can the following be p.m.f.

(i)

x	1	2	3	4	5
$p(x)$	0.2	0.3	-0.1	0.5	0.1

Since one probablity is negative it is not pmf.

(ii)

x	0	1	2	3	4	5
$p(x)$	0.1	0.3	0.2	0.2	0.1	0.1

Since $p(x) > 0 \ \forall x$
& $\Sigma P(x) = 1$
It is a pmf.

(iii)

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

Since $p(x) \rightarrow 0 \ \forall x$
ad $\Sigma p(x) \neq 1$
$\therefore$ It is not a pmf.

Find $P(x \leq 2)$, $P(2 < x < 4)$, $P($atleast $4)$, $P(3 < x < 6)$

x	0	1	2	3	4	5	6
	0.1	0.1	0.2	0.2	0.1	0.2	0.1

$\rightarrow$ $p(x<2)$

$p(0)+p(1)+p(2)$

$0.1+0.1+0.2$

0.4

$p(2\le x\le 4)$

$p(2)+p(3)$

$0.2+0.2$

0.4

$p(\text{atleast } 4)$

$p(4)+p(5)+p(6)$

$= 0.1+0.2+0.1$

$= 0.4$

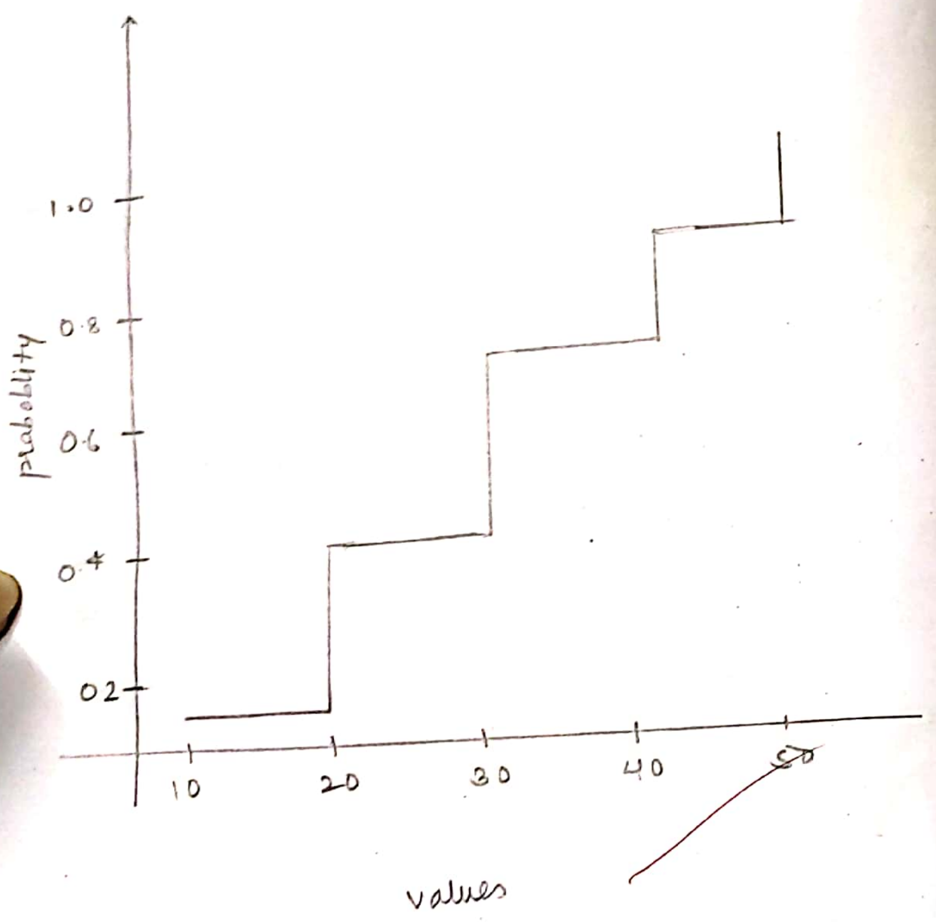
$p(3<x<6)$

$= p(4)+p(5)$

$= 0.1+0.2$

$= 0.3$

Graph of cdf



Practical 3

Probability Distribution

5) Find c.d.s of the following pmf draw the graph

x	10	20	30	40	50
$p(x)$	0.25	0.25	0.3	0.2	0.1

$f(x) = 0$ if $x < 10$

$= 0.15$ $\quad 10 \leq x < 20$

$= 0.40$ $\quad 20 \leq x < 30$

$= 0.70$ $\quad 30 \leq x < 40$

$= 0.90$ $\quad 40 \leq x < 50$

$= 1.0$ $\quad x \geq 50$

```
> x=c(10,20, 30, 40 ,50)
>prob =c(0.15, 0.25,0.3 ,0.2, 0.1)
> cumsum (prob)
[1] 0.15 0.40 0.70 0.90, 1.00
> plot (x, cumsum (prod) ,xlab = "values" ; ylab = "prabability",
main = "graph of cdf' , "s")
```

Binomial Distribution

Q2 Suppose there are 12 mcq in a test each question has 5 option & only one of them is correct. Find the probability of having
(1) 5 correct answer
(2) Atmost 4 correct

Given that
$n = 12, p = 1/5, q = 4/5$
x = Total no. of correct answer
$x \sim (B(n,p)$
$n = 12, p = 1/5, q = 4/5, x = 15$
> n=12; p=1/5; q=4/5; x=5
> sum (n,p,q,x)
[1] 18
> dbinom (5,12,1/5)
[1] 0.05315022
> pbinom (4,12,1/5)
[1] 0.9274445

Q3

There are 10 members in comittee, the probability of any member attending a metting is 0.9. find the prababiLity
1) 7 member attended
2) Atleast 5 members attended
3) Atmost 6 members attended.

→ Given that

$n = 10$, $p = 0.9$, $q = 0.1$

x = Total no. of member attended

$x \sim B(n, p)$

$n = 10$, $p = 0.9$, $q = 0.1$

$n = 10$; $p = 0.9$, $q = 0.1$

dbinom (7, 10, 0.9

[1] 6 0 573953

1 - pbinom (4, 10, 0.9)

[1] 0.~~998365~~) 999853)

> pbinom (6, 10, 0.9)

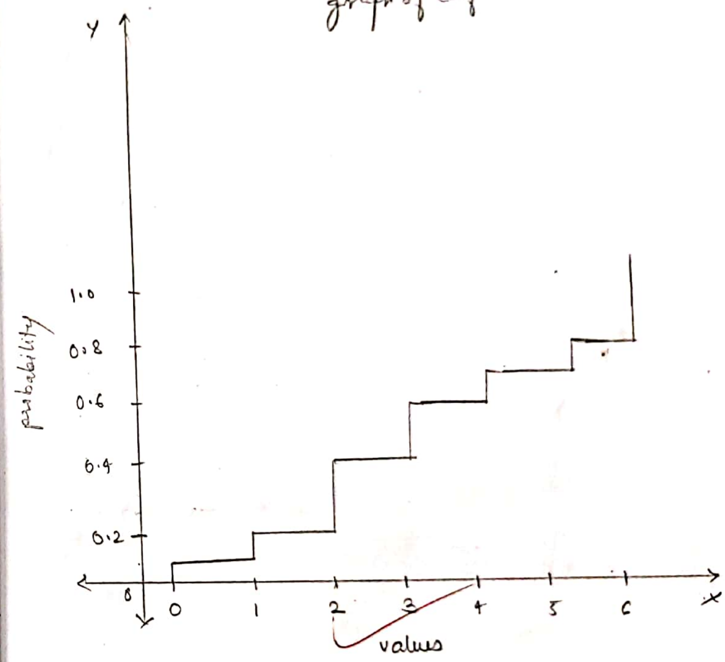
[1] 0.0127952

Find the c.d.f & draw the graph

x	0	1	2	3	4	5	6
$p(x)$	0.1	0.1	0.2	0.2	0.1	0.2	0.1

```
> x=c(0,1,2,3,4,5,6)
> prob=c(0.1,0.2,0.1,0.2,0.1,0.1,0.2)
> cumsum(prob)
>[1] 0.1 0.2 0.4 0.6 0.7 0.8 1.0
> plot(x,sumsum(prob),xlab="values",ylab="probablity",
  main="graph of cdf","s")
```

graph of cdf



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Practical 4

Binomial Distribution

1. Find the complete binomial distribution where $n=5$ & $p=0.1$

2. Find the probablity of exactly 10 success in 100 trials where $p=0.1$

3. X follows binomial distribution with $n=12$, $p=0.25$
Find (i) $P(X=5)$
(ii) $P(x \leq 5)$
(iii) $P(x > 7)$
(iv) $P(5 < x < 7)$

4) The probablity of a salesman makes a sale to a customer is 0.15. Find the prabablity
(i) No sale for 10 customer
(ii) More than 3 sale is 20 customer

5) A student writes 5 mcq's. Each question has 4 options out of which one is correct. Calcule the probability of atleast 3 correct answer.

6) X follows binomial distribution with $n=10$, $p=0.4$
Plot the graph of ~~pmf &~~ c.d.f.

* Note:
$P(x = x) = \text{dbinom}(x, n, p)$
$P(x \le x) = \text{pbinom}(x, n, p)$
$P(x > x) = 1 - \text{pbinom}(x, n, p)$

To find the value of X for which the probability is given as p1 command is qbinom
⇒ qbinom (p1, n, p)

Answer:

1) n = 5, p = 0.1
dbinom (0:5, 5, 0.1)

[1] 0.59049 0.32805 0.7290 0.00810 0.00045 0.00001

2) x = 10, n = 100, p = 0.1
dbinom (10, 100, 0.1)

[1] 0.1318653

3) (i) n = 12, p = 0.25
P(X = 5) = dbinom (x, n, p)
> dbinom (5, 12, 0.25)
[1] 0.1032414

i) $P(X \le 5)$ = pbinom (x, n, p)

```
> pbinom (5, 12, 0.25)
[1] 0.9455978
```

ii) $P(5 < x < 7)$ = dbinom (x, n, p)

```
> dbinom (6, 12, 0.25)
[1] 0.04014945
```

iii) $p(x > 7)$

$1 - P(x \le 7)$

```
> 1 - pbinom (7, 12, 0.25)
[1] 0.0278157
```

) $p = 0.15$

(i) $n = 10$, $p = 0.15$, $x = 0$

```
> dbinom (0, 10, 0.15)
[1] 0.1968744
```

) $p = 0.15$, $n = 20$

$P(x > 3) = 1 - P(x \le 3)$

```
> 1 - pbinom (3, 20, 0.15)
[1] 0.3522748
```

5) n. 5 , p- 1/4

P(x ≥ 3)

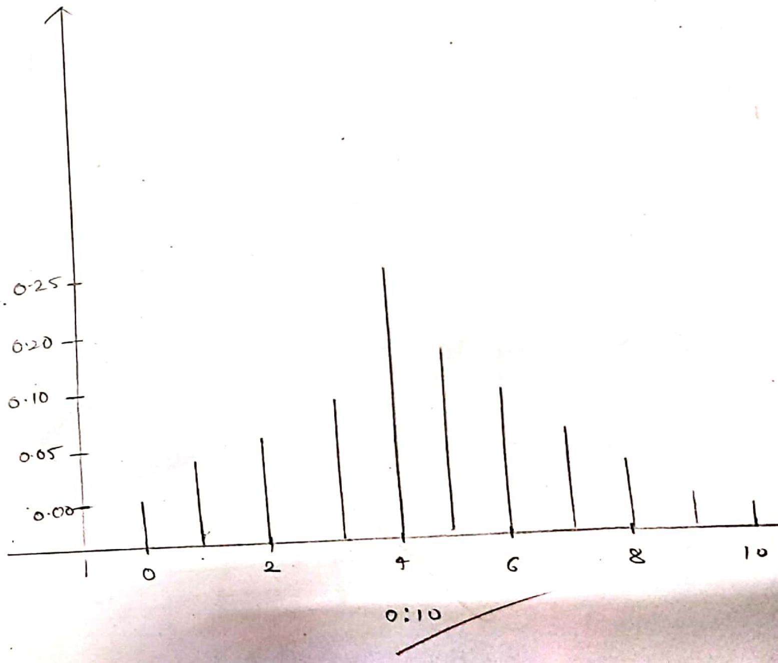
1- P(x ≤ 2)

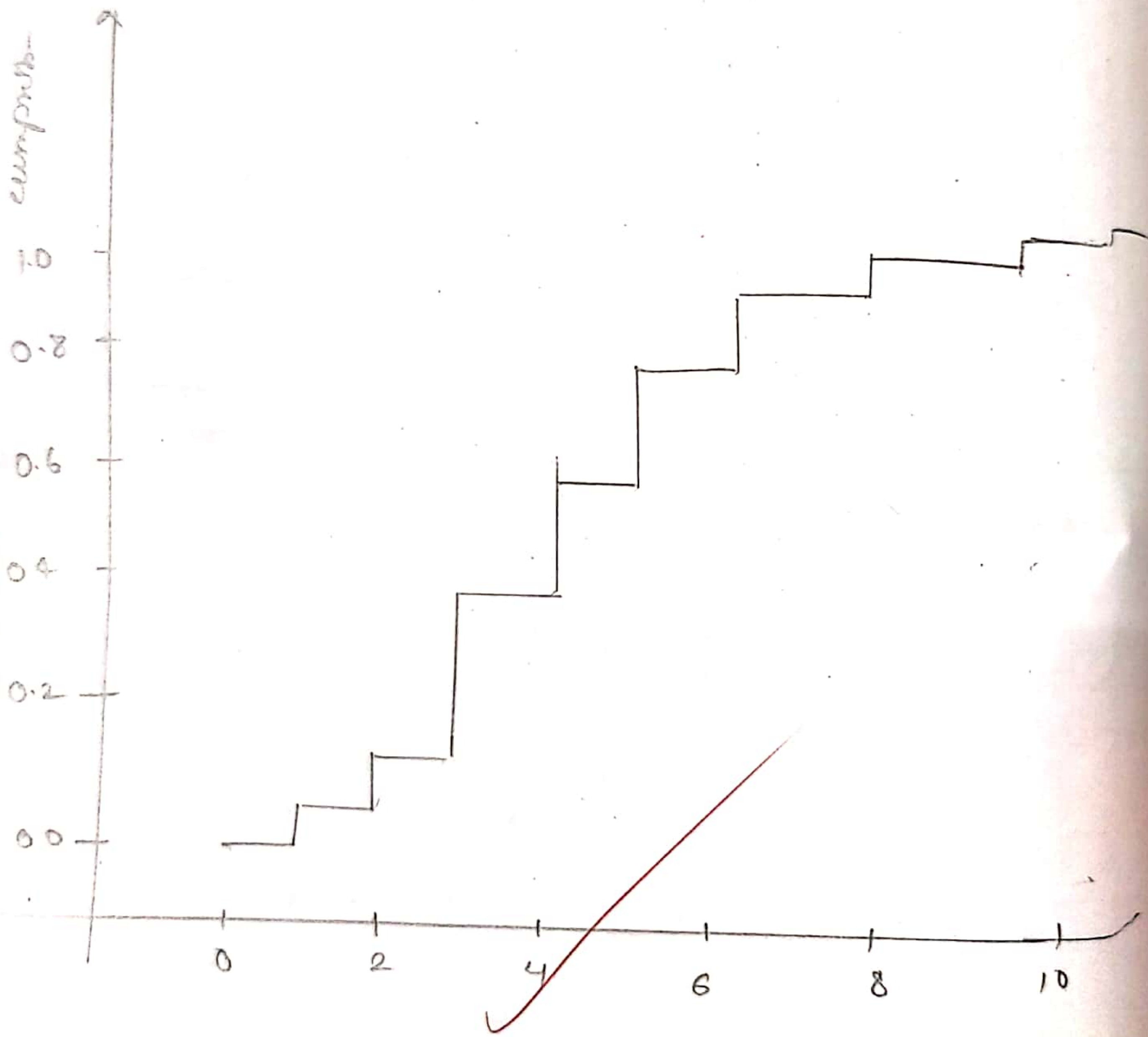
```
> 1- pbinom (3,5 ,1/4)
[1] 0.15625
```

c) n=10 , p= 0.4

```
x = 0:n
prob = dbinom (x,n,p)
cumprob = pbinom (x,n,p)
d = data.frame ("xvalues" = x ,"probability" = prob)
print (d)

>prob= dbinom (0:10,10,0.4)
>prob
>cumprob . pbinom (0:10, 10, 0.4)
> cumprob
> d= data.frame ("xvalues"= 0:10 ,"probability" = 0.4)
> print (d)
> plot (0:10, prob, "h")
> plot (0:10, cumprob, "s")
```





0:10

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Practical No. 5

Normal Distribution

* NOTE

$P(X=x)$ = dnorm (x, μ, σ)
$P(X \le x)$ = pnorm (x, μ, σ)
$P(X > x)$ = 1 - pnorm (x, μ, σ)
$P(x_1 < x < x_2)$ = pnorm (x_2, μ, σ) - pnorm (x, μ, σ)

To find the values of k so that
$P(X \le k) = P$; qnorm (p, μ, σ)
To generate n random no of the command is rnorm (n, λ, a)

1] $X \sim N(\mu = 50, \sigma^2 = 100)$
Find (i) $P(X \le 40)$
(ii) $P(X > 55)$
(iii) $P(42 \le X \le 60)$
(iv) $P(X \le k) = 0.7$, $k = ?$

2] $X \sim N(\mu = 100, \sigma^2 = 36)$
(i) $P(X \le 116)$
(ii) $P(X \le 95)$
(iii) $P(X > 115)$
iv) $P(95 \le X \le 105)$
v) $P(X \le k) = 0.7$) $k = ?$

3) Generate 10 random no form a normal distribution with mean $(\mu = 60)$ & S.D $(\sigma = 5)$
Also calculate the sample median, mean, variance & standard deviation.

4) Draw the graph of standard normal distribution.

Answers:

1] (i) >a = pnorm (40,50,10)
cat (P (X≤40) is ", a)

[1] 0.1586583

(ii) >b - 1- pnorm (55, 50,10)
cat (" P (X>55) is ", b)
[1] 0.3085375

iii) > c = pnorm (60, 50,10) - pnorm (42, 50,10)
[1] 0.6294893

iv) > d = qnorm (07, 50,10)
cat (" P (x≤k) = 0.7 , k is = ", d)
[1]

2] >a = pnorm (110, 100, 6)
[1] 0.9522096

(ii) >b = pnorm (95, 100, 6)
[1] 0. 2023284

iii) >c = 1-pnorm (115, 100, 6)
[1] 0.0062096̶5̶65

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iv) >d= pnorm (105,100,6) - pnorm (95,100,6)

[1] 0.5953432

v) >e = qnorm (0.1,100,6)

[1] 98.47992

3] n=10, μ=60, σ=5

> x = rnorm (10,60,5)

[1] 64.30801 56.28557 51.12444 62.66236 57.07212 52.90556

63.04319 57.3558 59.98091 87.45464.

> am = mean (x)

> am

[1] 58.30124

> me = median (x)

> me

[1] 58.22385

>n=10

> variance = (n-1)* var(x/n

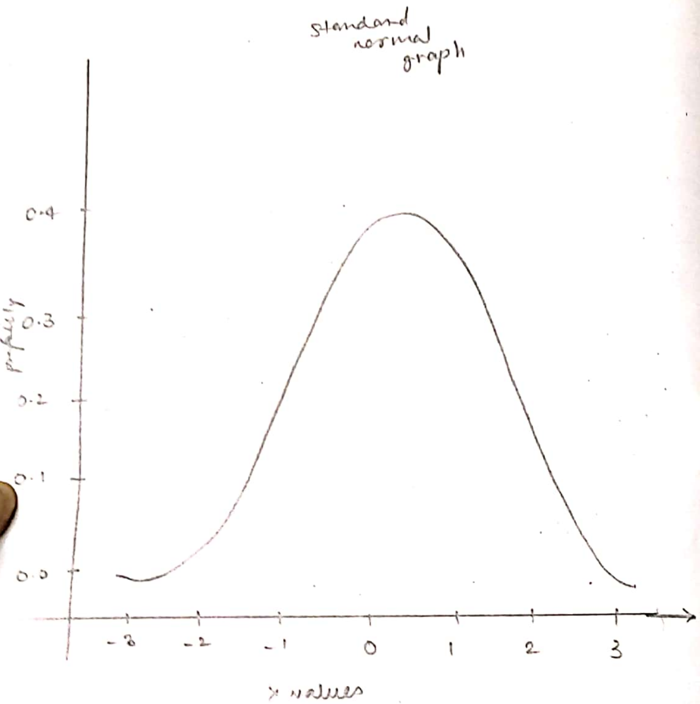
> variance

[1]17.05339

> sd= sqrt (variance)

>sd

[1] 4.129575



4) >x = seq(-3, 3, by=0.1)
>x

>y=dnorm(x)
>y
>plot(x,y,xlab="xvalues", "ylab="probality", 'main="standard normal graph")

8.1.20

Practical 6

X Distribution

1) Test the hypothesis (H_1) $H_0 : \mu = 10$ against $H_1 : \mu \neq 10$
A sample of size 400 is selected which gives the mean 10.2 & standard deviation 2.25. Test the hypothesis at 5% level of significance.

```
> mo=10 , mx= 10.2
> mo= 10 ; mx=10.2 ; sd = 2.25 ; n = 400
> zcal = (mx-mo) /(sd / sqrt (n)))
[1] 1.7778
> cat ("zcal is =", zcal)
[1] zcal is = 1.7778
> pvalue = 2 * (1 - pnorm Cabs (zcal))
> pvalue
[1] 0.07544036
```

∴ The answer is morethan 0.05, the value of the ~~line~~ H_0 is ~~correct~~ accepted

2) Test the hypothesis. $H_0 : \mu = 75$ against $H_1 : \mu \neq 75$. A sample at size 100 is selected ad sample mean is 80 with standard deviation of 3. Test the hypothesis at 5% level of signance.

```
> mo=75 , mx=80 , sd=3 , n=100
> zcal = (mx - mo )/(sd / sqrt (n)))
> zcal
[1] 16.6667
```

```
>cat ("zcal is = ", zcal)
zcal is = 16.667
> pvalue = 2* (1-pnorm (abs (zcal)))
> pvalue
[0]
```

Since, the value is less than 0.05, the value of H_0 is ~~incorrect~~ rejected.

3) Test the hypotesis $H_0: \mu = 25$ $H_1 \mu_1 = 25$ at 5% level of significance Following sample of 30 is selected
20, 24, 27, 35, 30, 46, 26, 27, 10, 20, 30, 37, 35, 21, 22, 23
24, 25, 26, 27, 28, 29, 30, 39, 27, 15, 19, 22, 20, 18.

```
>x = c(20,24,27,35,30,46,26,27,10,20,30,37,35,21,22,23,24,25
26,27,28,29,30,39,27,15,19,22,20,18)

>x
>mx= mean(x)
> mx
[1] 26.0667
> n= length (x)
> n
[1] 30
> variance= (n-1) *var (x)/n
> variance
[1] 52.99556
> sd = sqrt (variance)
> sd
[1] 7.279805
```

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>m0=25;mx=26.07,;sd=7.28;n=50
>zcal=(mx-m0)/(sd/(sqrt(n)))
>zcal
[1] 0.8050818
>cat("zcal is =",zcal)
[1] zcal is = 0.8050318
>pvalue=2*(1-pnorm(abs(zcal)))
> pvalue
[1] 0.4208013

∵ The value is more than 0.05; the value of H0 is ~~correct~~ accepted

5) Experiance has shown that 20% students of our college smoke. A sample of 400 students reveal that out of 400 only 50 smoke. Test hypothesis that the experience gives the correct proportion

> P=0.5
>Q=1-P
>p=50/400
>n=400.
>zcal=(p-P)/sqrt(P*Q/n))
>zcal
[1] -3.75
>pvalue=2*(1-pnorm(abs(zcal)))
>pvalue
[1] = 0.001768376

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value of Is less than 0.5, therefore Ho is rejected

5) Test the hypothesis Ho : p=05 against H1 : p≠0.5. Sample of 200 is selected & the proportion is calculated 0.56. Test the hypothesis at 1% level of signifiance.

```
> P=0.5
> p=0.56
> q= 1-P
> n=200
> zcal= (p-P) /sqrt (P*q/n))
> zcal
[1]  1.697056
> pvalue= 2* (1-pnorm (abs(zcal)))
> pvalue
[1]  0.08968602
```

Value of is morethan ~~is~~ 0.1, therefore Ho is accepted

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Practical No. 7

Large Sample Tests

A study of noise level in 2 hostpital is calculated below test the hypothesis that the noise level into hospital are same or not.

	Hos A	Hos B
No of sample	84	34
mean	61	59
S.D	7	8

Ho : The noise levels are same

n1 = 84

n2 = 34

mx = 61

my = 59

sdx = 7

sdy = 8

```
> z = (mx-my) / sqrt((sdx^2 /n1 ) + (sdy ^2 /n2))
> z
[1] 1.229059
> cat ("z calcuated is = ", z)
z calculated is = 1.229059 > pvalue = 2*(1-pnorm (abs (z)))
> pvalue
[1] 0.04550026
```

∴ since pvalue is is 0.0455, we reject Ho at 5% level of signifiance.

2) 2 random sample of size 1000 & 2000 are drawn from 2 population with a mean 67.5 & 68. respectively & with the same sd of 2.5. Test the hypothesis that the mean of 2 population are equal.

Ho = 2 populations are equal

n1 = 1000

n2 = 2000

mx = 67.5

my = 68

sdx = 2.5

sdy = 2.5

```
> z= (mx-my) /sqrt ((sdx^2 /n1) + (sdy ^2 /n2))
> z
[1] -5.163978
> cat ("z calculated is =", z)
z calculated is = -5.163978
> pvalue = 2 * (1-pnorm (abs (z)))
> pvalue
[1] 2.417564e-07
```

since pvalue is 2.417564e-07, we reject Ho at 5% level of singnifiance.

3) In a first year class (FYBsc), 20% of a random sample of 400 students had defective eye sight. In SY class, 15.5% of 500 sample had the same defect. Is the difference of proportion is same.

n1 = 400

n2 = 500

p1 = 0.2

p2 = 0.155

p = (n1 * p1 + n2 * p2) / n1 (n2)

\>p

[1] 0.175

\>q = 1-p

\>q

0.825

\>z = (p1-p2) / sqrt (p * q * (1 / n1 + 1 / n2))

\>z

[1] 1.76547

\> cat ("z calculated is = ", z)

[1] z ~~is~~ calculated is 1.76547

\> pvalue = 2 * (1- pnorm (abs (z)))

\> pvalue

[1] 0.07748487

Since pvalue is 0.077, we reject Ho at 5% level of significance.

4) From each of the box of apples, a sample size of 200 is collected. It is found that there are 44 bad apples in 1st sample & 30 bad apples in 2nd sample. Test the hypothesis that 2 boxes are equivalent in term of no. of bad apples.

Ho = The proportion of boxes is same.

n1 = 200

n2 = 200

p1 = 44/200

p2 = 30/200

```
>p = (n1 * p1 + n2 * p2)/(n1+n2)
> p
[1] 0.185
> q=1-p
> q
[1] 0.815
> z = (p1-p2)/sqrt(p*q*(1/n1 + 1/n2))
> z
[1] 1.8027
> cat ("z calculated is =", z))
calculated is 1.8027
> pvalue = 2* (1-pnorm(abs(z)))
> pvalue
[1] 0.0714
```

Since pvalue is 0.0714, we ~~reject~~ accept at 5% level of significance.

10.

In a MA class, out of sample of 60, mean height is 63.5 inch with a S.D 2.5. In a Mcom class, out of 50 student mean height 69.5 inch with sd of 2.5. Test the hypothesis that the mean of MA & Mcom are same

Ho- The mean height of MA & Mcom student are equal.

n1 = 60

n2 = 50

mx = 63.5

my = 69.5

sdx = 2.5

sdy = 2.5

```
>z = (mx - my) / sqrt ((sdx^2/n1) + (sdy^2/n2))
>z
[1] -12.53359
> cat ("z calculated is =", z)
z calculated is = -12.53359
> pvalue = 2 * (1 - pnorm (abs (2)))
> pvalue
[1] 0.04550026
```

since pvalue is 0.04550026 is, we reject Ho at 5% of level of significance.

An
5.2.20

Practical 8

Small Sample Test

Q1) The tons are selected & height are found to be 63, 68, 69, 31, 71, 72 cms. Test hypothesis that mean height a are 66cm or not at 1)

no. mean = 66 cms.

> mean = 66

> x = c(63, 63, 68, 69, 71, 71, 72)

> t.test(x)

one Sample t.test

data : x

t = 47.94, df = 6, pvalue = 5.22 - 0.9

alternative hypothesis: true mean is not equal to c 95 percent confidence interval.

64.66479 71.62092

Sample estimates

mean ~~estim~~ of x

68.14286

∴ pvalue < 0.01 is rejected on he in 1% level of significance

2) Two random sample was drawn from two different population

Sample 1 = 8, 10, 12, 11, 16, 15, 18, 7

Sample 2 = 20, 15, 18, 9, 8, 10, 11, 12

Test the hypothesis that there is no difference between the population mean at 5% los.

→ Ho There is no difference in the population mean.

> x = c (8, 10, 12, 11, 16, 15, 18, 7)
> y = c (20, 15, 18, 9, 8, 10, 11, 12)
> t.test (x, y)
welch two. sample t-test
data : x & y
t = -0.36247, df = 13.837, p.value = 0.7225
alternative hypothesis: true difference is mean is not equal
-5.192719 3.692719.
Sample estimates
mean of x mean of y
12.125 12.875

pvalue < 0.01 is accepted in the Ho on 1% level of significance

Q3 Following or the weights of 10 people.

Before = (100, 125, 95, 96, 98, 102, 115, 104, 109, 110)
After = (95, 80, 95, 98, 90, 100, 110, 85, 100, 101)
Ho - The Dist. program is not effective

> x = (100, 125, 95, 96, 98, 102, 115, 104, 104, 110)
> y = c(95, 80, 95, 98, 90, 100, 110, 85, 100, 101)
> t.test (x, y. paired = T. alternative = "less")
Paired t-test
data : x & y
t = 2.3215, df = 9, pvalue = 0.9773
alternative hypothesis : True difference is means is less than
95 percent confidence interval
-Inf 17.89635

Sample estimates :
mean of the differences
10.

Q4) Marks before & after a training program is given below
before - (20, 25, 32, 28, 27, 30, 35, 25)
after = (30, 35, 32, 37, 37, 40, 40, 23)
Test the hypothesis that training program is effective or not
Ho : The training program is not effective

> x = c (
> y = c (
> t. test (x, y, paired = T , alternative = "greater")
paired t.test
data : x and y
t = 3.3859 , df = 7, pvalue = 0, 9942
95 percent confidence interval
-8.967899 Inf.
Sample estimates
mean of the difference.
-5.75

Q5) Two random sample were

Q5 Two random sample were down from two normals population & the values are

A =

B =

Test wheather the population have same variance at 5% level of

Ho : variance of the population are equal

>x = c(66,67,75,76,82,84,88,90,92)

>y = c(64,66,74,78,82,85,87,92,93,95,97)

> var.test(x,y)

F test to compare two variences

data : x & y

F= 0.70686, num df =8 danom df = 10, p-value = 0.6359

altenative hypothesis : true ratio of variances is not equal to 1 9.5 percent confidence interval.

0.1833662 8.0360983

sample estimates :

ratio of variance

0.706886

8) The AP of sample 100 observation is 52 if S.D is 7 test the hypothesis that the population mean 55 or not at 5% of level of signifiance.

Ho: population mean = 55

```
> n=100
> mx=52
> mo=55
> sd=7
> zcal=(mx-mo)/sd/sqrt(n)
> pvalue=2*(1-pnorm(abs(zcal)))
> pvalue
[1] 1.82153e-05
```

Practical 9

Chi Square & ANOVA

use the following data to test wheather the of the name depends upon the child condition in not.

		cond of home clean	Dirty
cond of child	clean	70	50
	fairly dirty	80	20
	Dirty	35	45

→ Ho condition of the name & child are idependent

```
> x = c(70,80,35,50,20,45)
> m = 3
> n = 2
> y = matrix (x , nrow = m , ncol = n)

      [,1]  [,2]
[1,]   70    50
[2,]   80    20
[3,]   35    45

> pvalue = chisq.test (y)
> pvalue
```

Pearson chi squared test

data: y

X- squared = 25.646 , df = 2 , pvalue = 2.698 e-06

Pvalue is less than 0.05 we reject Ho at 5% LOS.

2. Table below show the relation between the performance of mathematics & computer of CS students

		maths		
		HG	MG	LG
	HG	56	71	12
Comp	MG	47	163	38
	LG	14	42	35

Ho: performance between maths & computer are independent.

x = c(56, 47, 14, 71, 163, 42, 12, 38, 85)

m = 3

n = 3

y = matrix (x, nrow = m, ncol = n)

	[,1]	[,2]	[,3]
[1,]	56	71	12
[2,]	47	163	38
[3,]	14	42	85

~~Practical 9~~

~~Pearson Chi-square test~~

1) ~~use the following data to~~
pvalue . chiq . test (y)
pvalue
data y
x - squared = 145 . 78 , , dr = 4 , pvalue < 2.2 e - 16

3)

varieties	deseration
A	50 , 52
B	53 , 55 , 53
C	60 , 58 , 57 , 56
D	52 , 54 , 54 , 55

mean ~~A~~,B,C,D
> x1 = c(50,52)
> x2 = c(53, 55, 53)
> x3 = c (60, 58, 57, 56)
> x4 = c (52, 54, 59, 55)
> d = stack (list (b1 = x1 , b2 = x2 , b3 = x3, b4 = x4))
> oneway. list (values ~ ind , data = d, var equal = T)
anova = aov (values ~ ind , data = d)
F = 11.735 , num dr = 3, denom df = 9 , pvalue = 0.0183
summary (anova).

	Df	sumsq	mean sq	F value	Pr (>F)
ind	3	71.06	23.688	11.73	0.00183
Residuls	9	18.17	2.019		

∴ Pvalue is less than 0.05 we reject Ho at 5% LOS.

Q.a.

Person's anova on the following table.

Types	Observation
A	6,7,8
B	4,6,5
C	8,6,10
D	6,9,9

a = c(6,7,8)
b = c(4,6,8)
c = c(8,6,10)
d = c(6,9,9)
d = stack

One way test (values ~ ind, data = d, var.equal = T)

One way analysis of means
data : values & ind
F = 2.6607 , num df = 3 , denom df = 8 , pvalue = 0.1
* anova = aov (values ~ ind , data = d)
> anova

Call
aov (formula = values ~ ind , data = d)

Terms

	ind	Residuals
sum of square	18	18
	3	8

Residual standard error : 1.5
Estimated effects may be unbalanced

>summary (anova)

	Df	sum sq	mean sq	F value	pr (>F)
ind	3	18	6.00	2.667	0.119
residuals	8	18	2.25		

Since the pvalue is greater than 0.05 we accept the hypothesis at 5% Los

15.

Practical - ~~10~~ 10

Non paramatric test

Following are the amounts of sulphur oxide by a factor
17, 15, 20, 29, 19, 18, 22, 25, 27, 9, 24, 20, 17, 6, 24, 14, 15, 23, 24, 26 apply sign test the hypothesis that the population medium is 21.5 against the alternative is less than 21.5

Ho : population median = 21.5
H1 : It is less than 21.5

```
> x = c(17,15,20,29,19,18,22,25,27,9,24,20,17,6,24,14,
    15,23,24,26)
> x
[1] 17 15 20 29 19 18 22 25 27 9 24 20 17 6 24 14
    15 23 24 26.
m = 21.5
sp = length [x [x > m])
sn - length (x [x < m])
> n = sp + sn
[1] 20
> pv = pbinom (sp, n, 0.5)
[1]   0.4119015
```

If the alternative is greater then mediam.
pv - pbinom (sn, n, 0.5)

2: For the observation 12,19,31,28,43,40,55,49,70,63, apply sign test to test population medium is 25 against the alternative. is more than 25.

```
> x = c(12,19,31,28,43,40,55,49,70,63)
> m = 25
> sp = length (x[x>m])
> sn = length (x[x<m])
> n = sp + sn
> pv = pbinom (sn,n,0.5)
> pv
[1] 0.0546875
```

3: For the following
60, 65, 63, 89, 61, 71, 58, 51, 48, 66. Test the hypothesis using wilcockson sign test. for tested the hypothesis that median is 60 against the alternative it is greater than 60.

H0: Median is 60.
H1: It is a greater than 60.

```
> x = c(60,65,63,89,61,71,58,51,48,66)
> m = 60
> sp = length (x[x>m])
> sn = length (x[x<m])
> n = sp+sn
> pv = pbinom (sn,no,0.5)
[1] 0.2539063
```

v = 27 , pvalue = 0.2886

Note : If the alternative is less , wilcox.test (x , alter = "greater" , mu = 60)

If the alternative is nt equal to wilcox.test (x , alter = "2 sided", mu = 60)

4. use wilcoxcokson sign, test the hypothesis where median is 12 against the alternative is less than 12

12, 13, 10, 20, 15, 5, 1, 7, 6, 11, 9, 20

```
x = c(12,13, 10, 20, 15, 5, 1, 7, 6, 11, 9, 20)
> m = 12
> sp = length (x[x>m])
> sn = length (x[x>m])
> n = sp+sn
> pv = pbinom (sn ,n, 0.5)
[1] data x
```

v = 25 , pvalue = 0.2521

Acc/Rej

A.Y
11.3.20