SEM 2

AS

Practical No. 1

Title: Random Variable

Q.1] find the mean and variance for the following

a].

X	−1	0	1	2
P(X)	0.1	0.2	0.3	0.4

Solution:

X	P(X)	X·P(X)	$E(X)^2$	$[E(X)]^2$
−1	0.1	−0.1	0.1	0.01
−0	0.2	0	0	0
−1	0.3	0.3	0.3	0.09
−2	0.4	0.8	0.	0.64
TOTAL	$\Sigma = 1$	$\Sigma = 1$	$\Sigma E(x)^2 = 0.20$	$\Sigma [E[x]]^2 = 0.74$

$\therefore$ Mean $= E(x) = \Sigma x_i . p(x) = 1$

$\therefore$ Variance $= V(x) = \Sigma E(x)^2 - \Sigma [E(x)]^2$

$= 2 - 0.74$

$= 1.24$

$\therefore$ Mean $E(x) = 1$ & Variance $V(x) = 1.24$

b]

X	−1	0	1	2
P(X)	1/8	1/8	1/4	1/2

x	P(x)	xP(x)	$E(x)^2$	$[E(x)]^2$
-1	1/8	-1/8	1/8	1/64
0	1/8	0	0	0
1	1/4	1/4	1/4	1/16
2	1/2	1	2	1
Total	$\Sigma = 1$	$\Sigma = 9/8$	$\Sigma = 19/8$	$\Sigma = 69/64$

$\therefore$ Mean $= E(x) = \Sigma x p(x) = 9/8$

$\therefore$ Variance $= V(x) = \Sigma E(x)^2 - \Sigma\,(E(x))^2$

$$= \frac{19}{8} - \frac{69}{64}$$

$$= \frac{152 - 69}{64}$$

$$= \frac{83}{64}$$

Mean $E(x) = 9/8$ and Variance $V(x) = 83/64$

c]

X	-3	10	15
P(X)	0.4	0.35	0.25

→

X	P(X)	XP(X)	$E(X)^2$	$[E(X)]^2$
-3	0.4	-1.2	3.6	1.44
10	0.35	3.5	35	12.25
15	0.25	3.75	56.25	14.0625
Total	$\Sigma = 1$	$\Sigma = 6.05$	$\Sigma = 94.8$	$\Sigma = 27.7525$

$\therefore$ Mean $= E(x) \cdot P(x) = 6.05$

$\therefore$ Variance $= V(x) = \Sigma E(x)^2 - Z(E(x))$

$= 94.85 - 27.7525$

$= 67.0975$

Mean $E(x) = 6.05$

Variance $V(X) = 67.09725$

2) If $P(x)$ is pmf of a random variable
If $P(x)$ represents pmf for random variable X.
find value of k. then evaluate mean & Variance

$\rightarrow$ As $P(x_i)$ is a part it showed stasify the properties of pmf which are :

a) $P(X_i) > 0$ for all sample space.

b) $\Sigma P(X_i) = 1$

X	-1	0	1	2
$P(X)$	$k+1/13$	$k/13$	$1/13$	$k-4/13$

$$\Sigma P(x_i) = \frac{k+1}{13} + \frac{k}{13} + \frac{1}{13} + \frac{k-4}{13}$$

$$1 = \frac{k+1+k+1+k-4}{13}$$

$13 = 3k - 12$

$15 = 3k$

$\boxed{k = 5}$

X	P(x)	x·P(x)	$E(x)^2$	$[E(x)]^2$
-1	6/13	-6/13	6/13	36/189
0	5/13	0	0	0
1	1/13	1/13	1/13	1/189
2	1/13	2/1/13	4/13	4/189
TOTAL	Σ=1	Σ=-3/13	Σ=11/13	Σ=41/89

$\therefore$ Mean $= E(x) = \Sigma x \cdot P(x) = \frac{-3}{13}$

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

$= \frac{11}{13} - \frac{41}{169}$

$= \frac{143 - 41}{169}$

$= \frac{102}{169}$

mean $= -3/13$ & variance $= 102/169$

Q.3) ~~find~~ The PmF of random variable x is given by.

X	-3	-1	0	1	2	3	5	8
P(x)	0.1	0.2	0.15	0.2	0.1	0.15	0.05	0.03

obtain cdf find 1) $P(-1 < x \leq 2)$

2) $P(1 \leq x \leq 5)$

3) $P(x \leq 2)$

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x	-3	-1	0	1	2	3	5	8	
P(X)	0.1	0.2	0.15	0.2	0.1	0.15	0.05	0.05	0.05
F(X)	0.1	0.3	0.45	0.65	0.75	0.90	0.95	0.95	1.0

① $P(-1 \leq x \leq 2) = P(X \leq 2) - P(X \leq -1) + P(X = -1)$

$= F(x_b) - F(x_a) + P(a)$

$= F(2) - F(-1) + P(-1)$

$= 0.75 - 0.3 + 0.2$

$= 0.25$

② $P(1 \leq x \leq 5) = E(x_b) - E(x_a) + P(a)$

$= F(5) - F(1) + P(1)$

$= 0.95 - 0.65 + 0.2$

③ $P(x \leq 2) = P(X = -3) + P(X = -1) + P(X - 0) +$
$P(X = 1) + P(X = 2)$

$= 0.1 + 0.2 + 0.15 + 0.2 + 0.1$

$= 0.75$

④ $P(x \geq 0) = 1 - F(0) + P(0)$

$= 1 - 0.4 + 0.15$

$= 0.40$

4) Let f be continous random variable with pdf

$$f(x) = \frac{x+1}{2} \quad -1 < x < 1$$

obtain cdf of x otherwise

→ By defination of cdf we have.

$F(X) \quad \int_{-1}^{1} t\,dt$.

$$\int_{-1}^{1} \frac{x+1}{2}\,dx$$

$$= \frac{1}{2}\left(\frac{1}{2}x^2 + x\right) \text{ for } -1 \leq x \leq 1$$

Hence the cdf is

$$F(X) = 0 \quad \text{for} \quad x \leq -1$$

$$\frac{1}{4}x^2 + \frac{1}{2}x \text{ for } = 0 \text{ for } x \geq 1$$

) Let f be Continous random variable with pdf

$$f(x) = \frac{x+2}{18} \qquad -2 \leq x \leq 4$$

$$= 0 \qquad \text{otherwise.}$$

calculate cdf

→ By definition of cdf we have

$$f(x) = \int_{2}^{4} t\,dt$$

$$= \int_{2}^{4} \frac{x+2}{18}\,dx$$

$$= \frac{1}{18}\left(\frac{1}{2}x^2 + 2x\right)$$

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for $-2 \le x \le 4$

Hence cdf is

$$f(x) = 0 \quad \text{for } x < -2$$
$$= \frac{1}{18}\left(\frac{1}{2}x^2 + 2x\right)$$

for $-2 < x < 4$

$$= 0 \quad \text{for } x \geq 4$$

Ven

Practical No.2

Title : Binomial Distribution

Q.1) An unbiased coin is tossed 4 times calculate the probability of obtaining no head, at least one head and more than one tail.

```
> dbinom(0,4,0.5)
[1] 0.0625
ATLEAST ONE HEAD
> 1 - dbinom(0,4,0.5)
[1] 0.9375
MORE THAN ONE TAIL:
> Pbinom (1,4, 0.5, lower.tail =F)
[1] 0.9375
```

Q.2) The probability that student is accepted to a prestigious college is 0.3. if 5 students apply, what's the probability of at most 2 are accepted

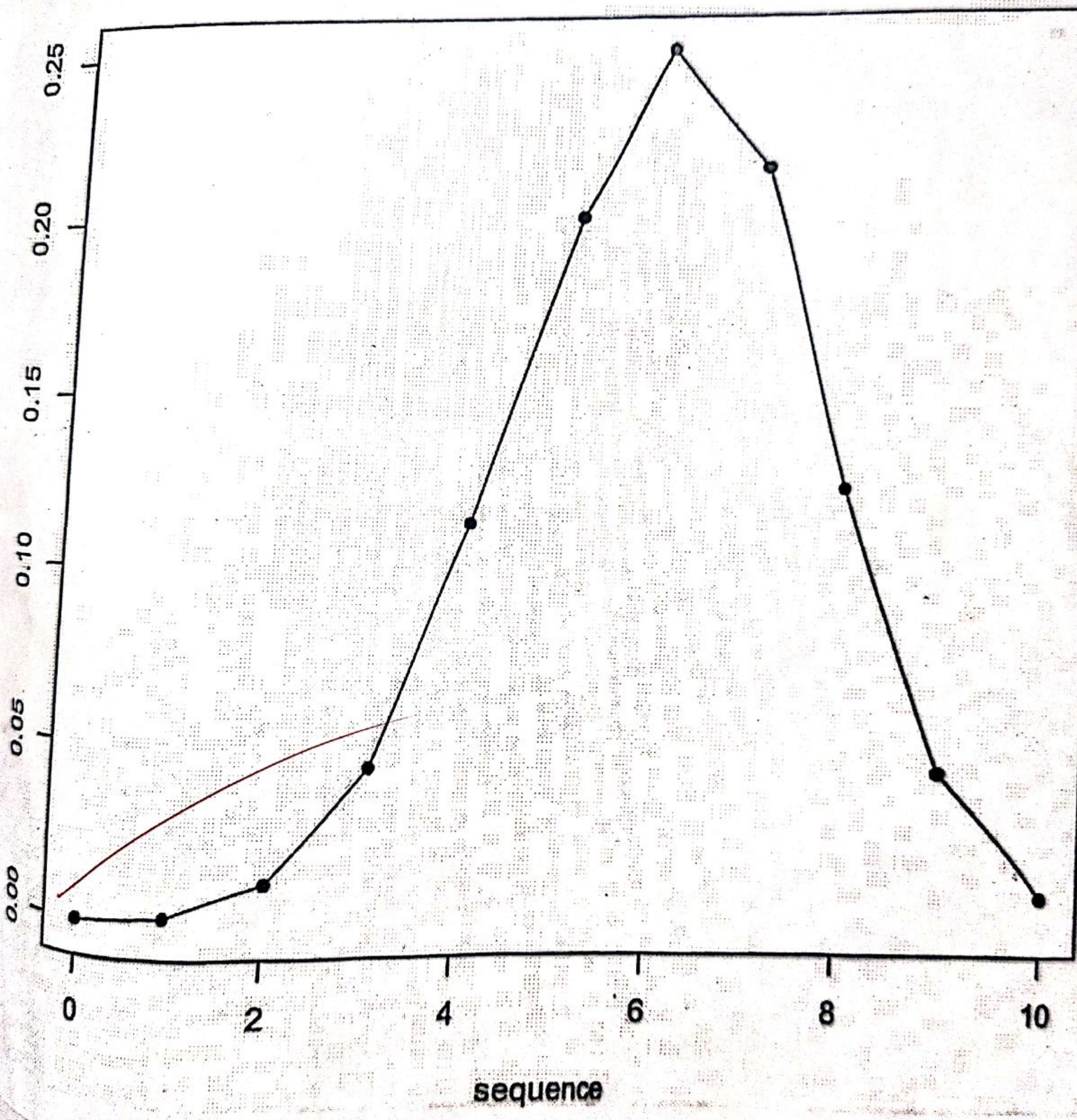
```
> pbinom(2,5, 0.3)
[1] 0.83692
```

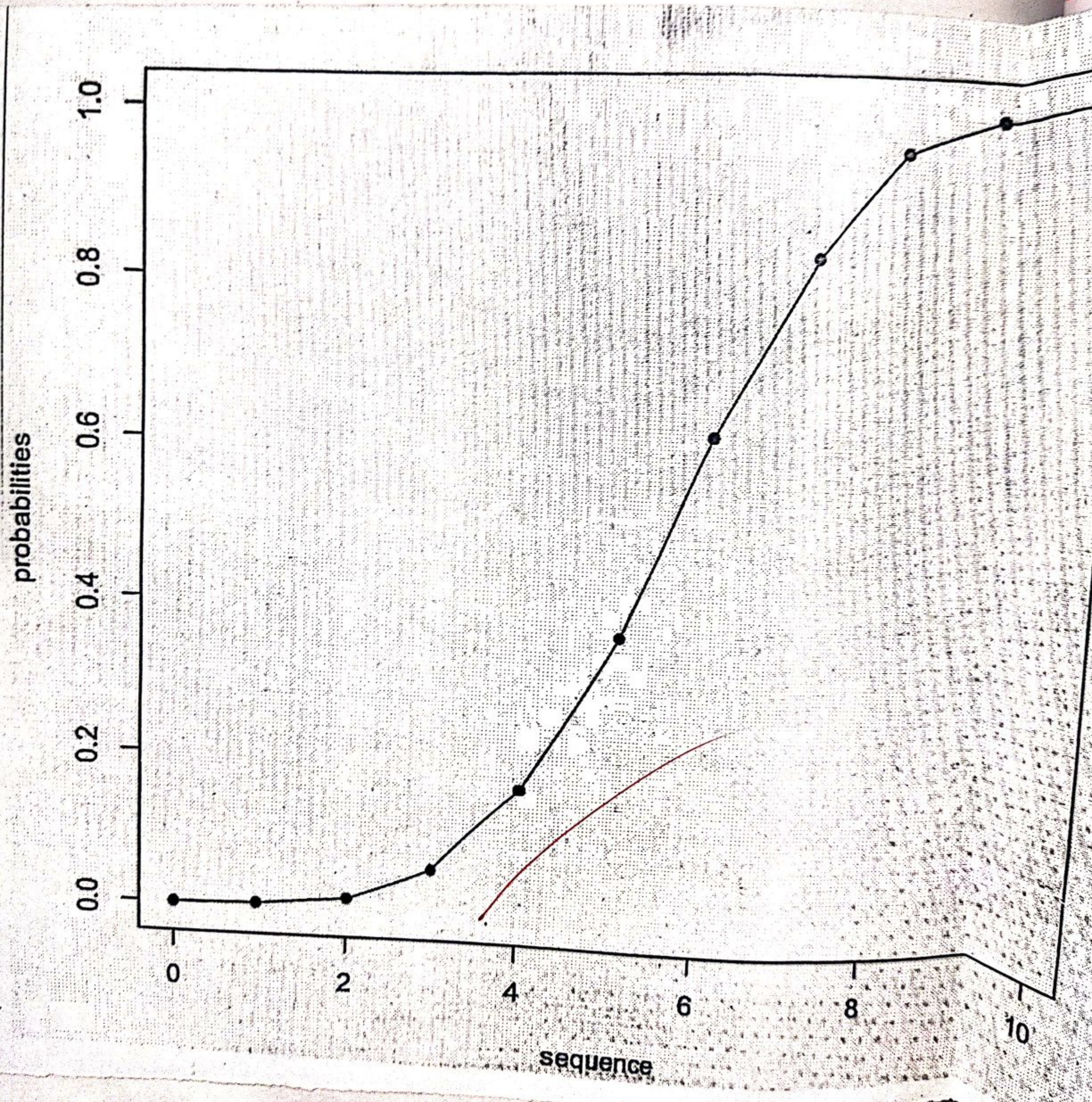
3) An unbiased coin is tossed 6 times the probability of head at any toss = 0.3 let x be no of heads that comes up calculate P(X = 2), P(X = 3), P(1 < x < 5)

```
> dbinom(2, 6, 0.3)
[1] 0.324135
> dbinom(3, 6, 0.3)
[1] 0.18522
> dbinom(2, 6, 0.3) + dbinom(3, 6, 0.3)
  + dbinom(4, 6, 0.3)
[1] 0.74373
```

4) For n = 10 p = 0.6, evaluate bionomial probabilities and plot the graphs of pmf & cdf

```
> x = seq(0, 10)
> y = dbinom(x, 10, 0.6)
> y
[1] 0.0001048576   0.0015728640   0.0106168332
    0.0424673280   0.1114767360   0.2006581248
    0.2508226560   0.2149908480   0.1209323520
    0.0403107840   0.0060466176
> plot(x, y, xlab = "sequence", ylab =
  "probabilities", "a", pch=16)
```


0.00
0.05
0.10
0.15
0.20
0.25
0
2
4
6
8
10
sequence


probabilities
0.0
0.2
0.4
0.6
0.8
1.0
sequence
0
2
4
6
8
10

> x = seq(0,10)
> y = pbinom(x, 10, 0·6)
> plot (x, y, x·lab ,= "sequence", ylab= "probability", "01", pch =16,

5) Generate a random sample of size 10 for a B·D → B(0·3) find the mean & the variance of the sample

> ~~sp~~ rbinom (9, 10, 0.3)
[1] 2 2 3 4 3 4 2 3
> mean (rbinom (8, 10, 0·31)
[1] 2·375
> var (rbinom(8, 10, 0.31)

Q.6) The probability of men hitting the target is 1/4 if the shoots 10 times what is the probability that he hits that the hits target at least one.

> qbinom (3, 10, 0.25)
[1] 0·25 0 2823
> 1 - qbinom ·(1, 10, 0·25)
[1] 0·8122883

> pbinom [

[1] 0.340

Practical No. 3

TITLE : NORMAL DISTRIBUTION.

1) A normal distribution of 100 students with mean marks 40 & deviation - 15 Find the no. of students whose marks are (1) less than 80
(2) 40 & 70
(3) 25 & 35
(4) more than 60.

→ mean = 40
s.d = 15
0.5 - pnorm(50, 40, 15)
0.2524725
pnorm (10, 40, 11) - pnorm(40, 40, 15)
0.4839377
Pnorm (35, 40, 15) - Pnorm(25, 40, 18)
0.2107861
more than 60
pnorm (60, 40, 15, lower.tail = F)
0.0912112

2.) If the random variable 'x' follows to the normal distribution with mean 50 variance 100 . Standard deviation
find (1) P (x < 70) (2) P(x > 55) (3) (x ≤ 30)
(4) P(35 < x < 60) (5) P(20 < x < 32)

Pnorm (34, 50, 10) - Pnorm(20,50,10)

- 0.05482180

3) let $x \sim (60, 400)$ find let (2)

such that $(x < |c1) = 0.6$

$p(x > k2) = 0.8$

→ qnorm(0.6 , 160, 20)

165.0669

qnorm (0.2, 160, 20)

143.1676

4) A random variable x follows normal distribution with $\mu = 10$ $\sigma = 2$ generally 100 observation and find mean, median & variable

→ pnorm (100, 10, 2)

mean = 9.911

median = 9.928

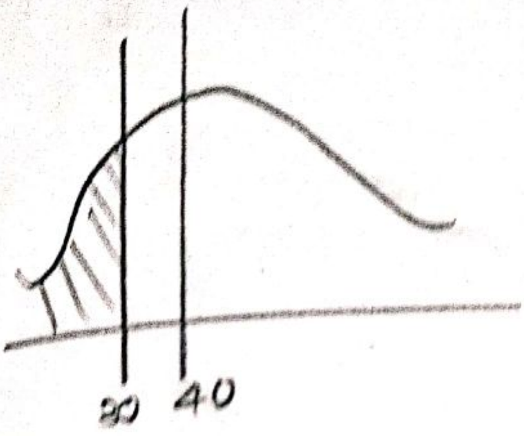
variable = 4.13785

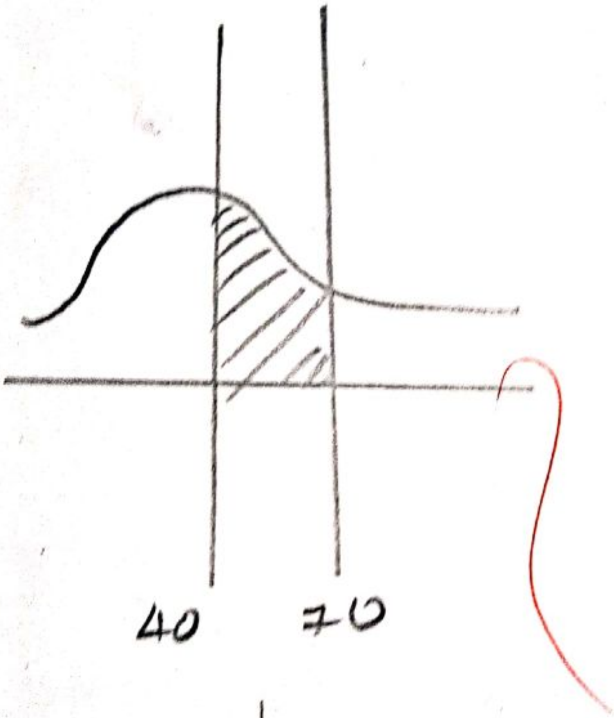
5) write a command to generate 10 random no.s for sd deviation 4. find the sample mean & median.

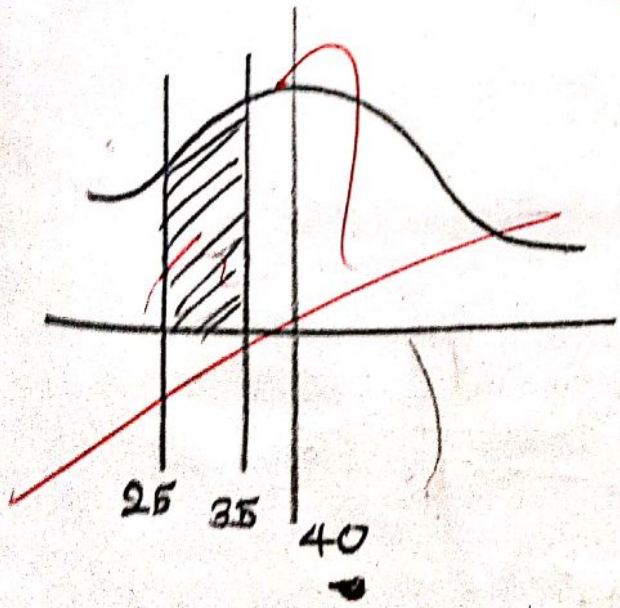
→ pnorm(10, 50, 4)

mean = 51.4

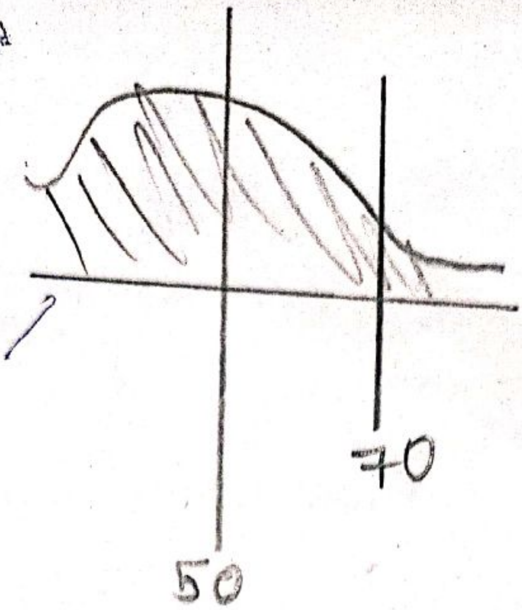
median = 4 5 ..


30
40

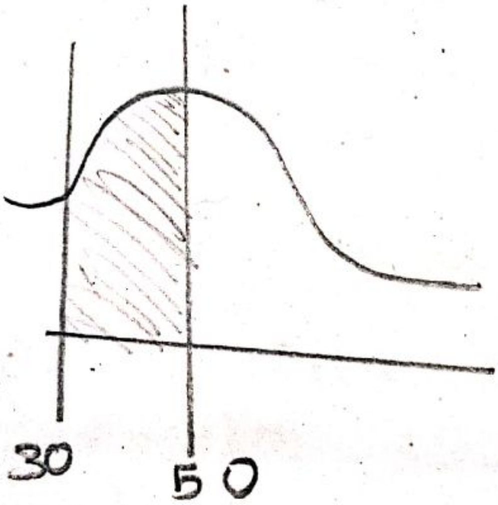

40
70

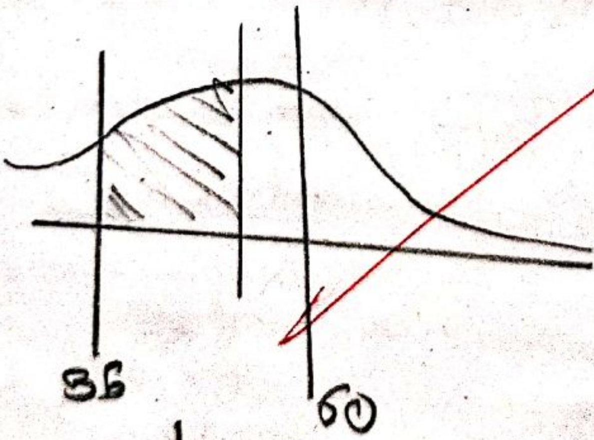

25
35
40

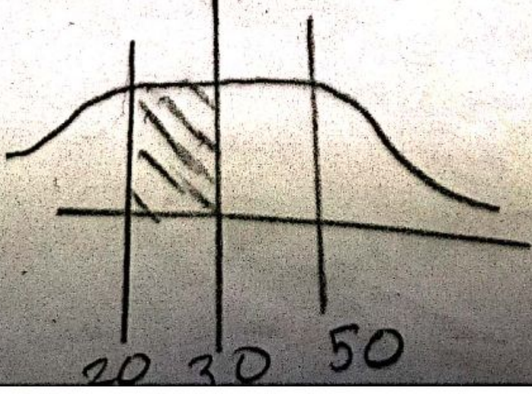
a)



b)







Practical No. 4

Aim : Sample mean & deviation given single population.

Q.1) Suppose the food level on the cookie bg bag that it has almost of seaweed salt in a single cookie In a sample of 35 cookies it was found that mean and average of seaweed salt is 21g. Assume the S.D is 0.3 (5% level of significance)

$\Rightarrow$

$\sigma = 0.3$

$n = 35$

$\bar{x} = 2.1$

$x = 2$

x_0 = (null hypothesis) $= \mu < 2$

x_1 = (ALL hypothesis) $= \mu > 2$

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$z = \frac{2.1 - 2}{\frac{0.3}{\sqrt{35}}} = 1.972021$$

p-value = 1 − pnorm (z)
= 0.0243

∴ Reject the null hypothesis ∵ p value < 0.05
∴ Accepted alternate hypothesis

Q.2] A sample of 100 customers was randomly selected & it was found that already was 275%. the SD = 30 using 0.05 level of significance, would you conclude that the aim spent by the customer is more than 250%. whereas the restaurant claim that it is not = 250%.

⇒ $\bar{x} = 275$, $\mu = 250$, $\sigma = 30$, $n = 100$

$x_0 = \mu \leq 250$

$x_1 = \mu > 250$

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = 8.333$$

⇒ pt (z, 99, lowertail = F)

∴ P-value = 2.305 + 36 e-13

⇒ Reject the null ~~&~~ hypothesis pvalue < 0.05
Accept the alternate hypothesis ($\mu > 250$)

Q.3] A quality control engineer finds that sample of 100 have average like 470 hours. Assuming population test whether the population means is 480 hours vs population means >980 hours at 1.05 → 0.05

$n = 100$, $\bar{x} = 420$, $\mu_1 < 480$, $\sigma = 25$

$\mu = 980$

→ $z = \frac{\bar{x} - y}{\sigma} = -4$

pt(7, 99 lowmartail = T)

= 1.112576e05

Reject the null hypothesis

p > 0.08

accept the alternative hypothesis.

$m_1 < 780$.

Q.4) A principal at school claims that the IQ is 100 of the students. A random sample of 30 students whose IQ was found to be 112. The SD of population is 15. Test the claim of principal.

> method 1 : 1 tail test

$x_0 = \mu = 100$

$x_1 = \mu = 100$

$\bar{x} = 112$, S.D = 15 $\mu = 100$; n = 20

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{112 - 100}{\frac{15}{\sqrt{30}}} = 4.38118$$

P value = 6 - 8856 e 06.

⇒ Reject the null hypothesis claims of principal ($\mu = 100$)

method 2 : 2 tail test

$\mu_0 = \mu = 100$

$\mu_1 = \mu = 100$

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P value = 2 × (1 − pnorm [ans (z))) = 1.77134

→ Reject the null hypothesis ∵ P value = 0.05

SSP

* Single population portion.

Q.4) It is belived that coin is fair the coin is tossed 40 times 125 times head occurs. Indicate whether the coin is fair or not at as % COC

$$\Rightarrow z = \frac{p - P_0}{\sqrt{\frac{P_0 q_0}{n}}}$$

$P_0 = 0.5$ $q_0 = 1 - P_0 = 0.5$ $P = \frac{28}{40} = 0.7$

$n = 90$

$$z = \frac{0.7 - 0.5}{\sqrt{\frac{0.5 \times 0.5}{40}}}$$

$x_0 = u = 0.5$

$x_1 = u \neq 0.5$

→ pvalue = 2 × (1 − pnorm (abs (z)))

∴ P value = 0.01141209.

→ Reject the null hypothesis ∴ $P < 0.05$

Accept the alternate hypothesis.

Equality of 2 population proportion.

In an early election campaign a telephone phono of 800 registered votes shows favour 460. In second pole opinion 520 of 100 registered voters favoured the ~~Cndit~~ Candidate at 5% level of confidence is three sufficient evidence that popularity has decreased

$H_0 = P_1 \neq P_2$

$H_1 = P_1 \neq P_2$

>P = (460*800 + 520 * 1000) / (520+1000)
>P
>[1] 0.544
> 1-0.544
> 0.456
> z = sqrt (0.544 * 0.456*(1/526 + 1/1000))

> * (1-Pnorm (abs(a)))
[1] 0.5444
Accept NO.

2) From a consinment 200 articles are drawn and 44 was found defective from consinment B. 200 sample ~~test~~ whether the proportion of defective items in consinment are significantly.

4.3

Ho = P1 = P2

H1 = P1 ≠ P2

> (0.22 * 200 + 0.15 * 200 / (1 * 200 + 1/200))

> ~~0~~ . 0.185

> 1 - 0.185

> z = (0.185 * 0.815 * (1/200 + 1/200))

> z * (1 - pnorm (abs (2)))

[1] 0.9969018

Accept Ho.

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Practical No. 5

AIM: Chi square test

Q.1] Use the following data to test whether the attribute condition of home and child are independent.

Condition of child	Clean & cleandirty	Condition of Homes clean	dirty
		70	50
		80	20
		35	45

H0 = Both are independent, H1 = Both are dependent.

```
> x =c(70,80,35)
> y=c(50,20,45)
> z = data.frame(x,y)
> Z
[1]     x    y
   1   70   50
   2   80   20
   3   35   45
```

> chi-squaretest → chisqtest(z)

Pearson's chi squared test

data : z

x - squared = 25.646, df =2, P-value =2.698 e-06

∴ Reject the null hypothesis.

∴ Both are dependent.

Q.2] A dice is tosed 120 times and following ~~100~~ rolls are obtained

NO. of terms	frequency
1	30
2	25
3	18
4	10
5	22
6	15

Test the hypothesis that dice is unbaised

∴ H_0 = dice is biased

∴ H_1 = dice is biased

```
>obs = c(30,25,18,10,22,15)
> exp= sum (obs) / length (obs)
> exp.
[1] 20
> z = sum ((obs - exp)^2 / exp)
> Pchisq (z, d=length (obs)-1)
[1] 0.956659
```

∴ Accept the null hypothesis

∴ dice is biased.

Q.3) An IQ test was conducted and the student's were observed before and after traning the result are following.

before	After
110	120
120	118
123	125
132	136
125	

Test whether there is change in the IQ after the traning.

∴ H_1 = No change in IQ

∴ H_0 = IQ increased after traning.

```
>a = c(120,118,125,136,121)
>b = c(110,120,123,132,125)
>z = sum((b-a^2/a)
>pchisq (z, df = length(b), 1)
[1] 0.1135959
```

Accept the null hypothesis

∴ There is change in IQ after traning.

Q.4)

	Graduate	undergraduate
Online	20	25
facetoface	40	5

Is there any association between students's preference for type of education and method.

∴ H_0 : Independent

H_1 : Dependent

```
>x = c(20,40,25,5)
> z = matrix(x, nrow = 2)
> chisq.test(z)
        Pearson's chisquared test with yates
data : z
x : squared = 18.05, df = 1, P-value = 2.157e-05
```

#N

∴ Reject null hypothesis.
∴ Both are dependent.

A dice is tossed 180 times

No. of terms	frequency
1	20
2	30
3	35
4	40
5	12
6	43

Test the hypothesis that dice is unbaised

H_0 = dice is biased
H_1 = dice unbiased

```
> x = c(20,30,35,40,12,43)
> chisq.test(x)
```

chi squared test for gino probabilities
data: 2
x-squared = 23.933, df = 5. pvalue = 0.0002236

∴ Reject null hypothesis.
∴ dice to unbiased.

Practical No. 6

Title : T test

Q.1] let x = 3366, 3337, 3361, 3410, 3316, 3357, 3338, 3356, 3376, 3382, 3377, 3355, 3408, 3407, 3398, 3424, 3328, 3374, 3384, 3374.

write the R command for following to test

① $H_0 : u = 3400$, $H_1 : \mu \neq 3400$.
② $H_0 : m = 3400$ $H_1 : \mu > 3400$.
③ $H_0 : u = 3400$ $H_1 : \mu < 3400$
at 95% level of confidence Also check at 97% level of Confidence

Ans: $H_0 = \mu = 3400$
$H_1 : \mu \neq 3400$

> to test (x, mu=3400, alter = -1one sided''
config.level = 0.45)
one sample test

data: x
t = -4.4865, df = 19, Pvalue = 0.0002528
alternative hypothesis true mean is not equal to 3400
95 percent confidence level
336(0 759) 3386.103

Sample Estimate:
mean of x :
3373.95.

Sample Estimate:

mean of x :

3373.95

∴ Reject H_0

∴ Accept H_1

> t-test (x, mo ·3400 alter = "two sided", conf·level =0.97)

one sample % test

data : x

x = -4.4865 , uf = 19 , pvalue = 0.002528

alternative hypothesis : true mean is not equal to 340

3360.33   3387.57

Sample Estimate

mean of x : 3373.95

∴ Reject H_0

∴ Accept H_1

2) $H_0 = u = 3400$

$H_1 = u > 3400$

> to test (x, m_0 = 3200, alter="greater", cof·level = 0.95 / one sampletest

data : x .

t = -4.4865 , df = 19 , p value = 0.002528

95 percent confidence
sample Estimate
~~mean as x~~
alternative hypothesis true mean is greater than
3400
3363.91 Inf.

$\mu_0 \neq \mu_1 = 3400$
$\mu_1 = \mu < 3400$
>t.test (x mm= 3400 alter = "less" confilevel=0.95
one sided t. test
data : x
→ -4.9866 , dF = 19, P.value = 0.0001264
alternative hypothesis true mean is less than
3400
95 percent level as Confidence . hf 3383.99

Sample Estimate
mean as x :
3373.95
∴ Reject H_0 ∴ Accept H_1

>t . test (x, mo = 3400 , alter = "less" , confi level=097
one sample to.test
data : x
t = -4 . 4866 df = 19, p-value = 0.0001264 .
alternative hypothesis : True mean is less .

then 3400

97 percent of confidence.

inf 3355.563

Sample Estimate :

mean of x

3373.95

∴ Reject Ho ∴ Accept H_1

Below are the data of gain in weight on 2 different diets A & B

Diet A : 25, 32, 30, 43 ~~4~~ 24, 24, 14, 32, 24, 31
35, 25

Diet B = 99, 34, 22, 10, 47, 31, 40, 30, 30, 32
35, 18, 21

Ans : ∴ $H_0 = a - b = 0$ $H_1 = a - b \neq 0$

> a = c(25, 32, 30, 93, 24, 14, 32, 24, 31, 31
18, 21)

> b) = c(99, 34, 22, 10, 47, 31, 90, 30, 32,
24, 31, 31, 18, 21)

t-text (a, b, paired = T. alter = "two sided"
config level = 0.095)

Paired. t-test

data : A & B

$H_0 = S, -52$

$H_1 = S, \neq 52$

```
> CA <- c(53,490, 58850, 49495, ...
> CB: c(53490, 58850, 49 ...
> t test (ca, cb, paired = T, ...
       conji level = 0.95)
```

Paired test

data = ca and cb

t = test (ca, cb, paired ...

conf level = 0.95)

alternative hypothesis : true difference in means in less than 99 percent confidence interval :

-inf 0.863333.

Sample estimate:
mean of the difference :

-1

Accept H0

Q.4) Two drugs for BP was given & data was Collected.

D1 : 0.7, -1.6, -0.2, -1.2, -0.1, 3.4, 3.7, 0.8, 0.2

D2 : 1.9, 0.8, 1.1, 0.1, -0.1, 4.4, 5.5, 1.6, 4.6, 3.4.

>t.test(d1, d2, alter = "Two-sided", paired = 1. conf level = 0.95

Paired t test

data : d1 and d2

t = -4.062, df = 4, p value = 0.002833

alternative hypothesis ; two difference in means is not equal to 0.

95 percent confidence intervals

mean of the difference : -1.58

∴ Reject H0 ~~Re~~ Accept H1.

Q.5) If there is difference in salaries for the same job in 2 different countries.

CA : 53000, 49958, 41974, 44366, 30470,
CB : 62490, 58850, 49995, 52263, 47674, 43552.

$\therefore H_0 : S_1 = S_2$

$\therefore H_1 = S_1 \neq S_2$

```
> CA : c(63,490, 58850, 49495, 52263, 47674, 43352)
> CB : (63490, 58850, 49495, 58.263, 47674, 43352
> t.test (ca.cb, paired = T, alter = "two sided",
         confi level = 0.95)
```

Paired test
data = ca and cb
t.. test (ca, cb, paired = T, alter= "two sided",
confi. level = 0.95)

Paired test
data = ca and cb
t = 4.456, df= 5, p-value = 0.00666,
alternative hypothesis : true difference in mean is not equal to 0.
45 percent confidence interval :
-10404. 821
Sample estimates :
mean of the difference
$\therefore$ Reject Ho
$\therefore$ Accept H_1

Practical No. 7

1] Title : F Test

1] The exceplancy in 10 region of india in 1990 and 2000 are given below test weather the variance at the 2 times are same :

1990 , 27, 33 , 36 , 42, 45, 38 , 46 , 43 , 50, 51,
2000 , 44, 45, 47 , 48 , 42 , 49 , 50 , 41 , 43, 50,
47, 52 , 42, 53

x=c(37, 33 , 36 , 42, 44 , 46 , 43 , 50, 51)
y=c (48, 45, 47 , 48, 42, 49, 50 , 41 , 48, 52, 42, 53)
var. test(x,y)

F test to compare two variance
data : x and y
F = 1.0548, num df = 9 , denom df = 11, pvalue = 0.491
alternative hypothesis : Hence ratio of variance is not equal to 95 percent confidence interval
0.2828877 4.1265887
Sample estimate
ratio of variance
1.054824
∴ Accept H_0
∴ Variance at 2 time are same

Q.2) I 25 28 26 22 22 29 31 31 26 31

II 30 25 31 32 23 25 36 26 31 32 32 27 31 28 24

50

at 95% of confidence level check the ratio of the population variance.

$>x = c \quad \therefore H_0 = \sigma_1^2 = \sigma_2^2$

$H_1 = \sigma_1^2 \neq \sigma_2^2$

> x = c (25, 28, 26, 22, 27, 31, 26, 31)

> y = c (30, 25, 31, 32, 23, 25, 36, 25, 25, 31, 32, 32, 27, 31, 38, 24)

> var. test (x, y)

> F. test to compare two variance

Pvalue = 0.4535.

Accept the Ho

∴ Variance of I and II are same.

Q.3) For the following data test the hypothesis for.

1) Equality of 2 population mean → t. test

2) Equality of proportion variance → F. test

Sample 1 : 175, 168, 145, 140, 190, 181, 185, 175, 200.

Sample 2 / 180, 170, 153, 180, 183, 179, 183, 187, 205.

(1) $H_0 = \mu_1 = \mu_2$

$H_0 = \mu_1 \neq \mu_2$

> x = c (175, 168, 145, 190, 181, 185, 175, 200)

> y = c (180, 170, 153, 180, 179, 183, 187, 205)

> t. test (x, y, alter = "two sided", conf. level = 0.95)

watch two sample t. test

p-value = 0.777!

Accept Ho

equality of 2 population mean are same.

(2) equality of proportion variance

>val.test (x, y)

F.test to compare two variances

P-value = 0.7759

∴ Accept Ho

∴ equality of proportion variance are same.

Q.4) The following are the price of commodity in the sample of shops selected at random from ~~differt~~ different city.

CityA: 79.10, 77.70, 75.35, 74, 73.80, 79.30, 75.80, 76.80, 77.10, 79.40

City: B: 70.80, 74.90, 76.20, 72.80, 78.10, 74.40, 69.80, 81.20)

∴ ~~Ho = σ2~~

∴ $H_0 : \sigma_1^2 = \sigma_2^2$

$H_1 = \sigma_1^2 \neq \sigma_2^2$

> x=c (74.80, 77.10, 75.3), 74, 73.80, 79.30, 75.80. 79.30, 76.80, 77.10.76.04)

>c(70.80, 74.90, 76.20, 72.80, 78.10, 74.40, ~~3~~ 69.80, 81.20)

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> val.test (x, y)
t.test to compare two variance
P value = 0 02756
∴ Reject Ho
∴ equality of 2 population mean not same.
> t.test (x, y, var.equal = F, Paired = F
Welch Two sample t.test.
P-value = 0.3244
Accept Ho
∴ mean of two population is same.

Q5) Prepare a CSO file in excel import the file in R and apply the test to check the equality of variance of 2 data.
observed 1: 10, 15, 17, 11, 16, 20
observed 2: 15, 19, 17, 19, 11, 12, 19
∴ $H_0 = \sigma_1^2 = \sigma_2^2$
$H_1 = \sigma_1^2 \neq \sigma_2^2$
Save the above observation in excel file CSU(MS - HOS) format.
> ~~at~~ data = read.csv(file.choose(), header=T)
> attach (data)
> var.test(OB.1, OB.2)

	OB I	~~OS~~. OB 2.
		15
1	10	17
2	15	10
3.	17	11
4	11	12
5	16	19
6	20	

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T. test to compare two variance
P-value = 0.5717
∴ Accept Ho
∴ The variance as 2 atr are same

~~Practical No. 8~~

~~Topic: Non param test~~

~~Q.1) The times of failures in hours after 10 randomely selected 9 volt battery of a certain company is as follows :- (28.9, 1.2, 28.9, 72.5, 78.5, 52.4, 37.6, 49.5, 62.1, 54.5) test the hypothesis that the population median is 63 against alternative is than 63 at 5%. (level of signature significan)~~

~~Solution: ∴ Ho = median = 63~~
~~H1 = median = 63~~

Practical No. 8

Topic: The times of failures in hours after 10 randomly selected 9 volt battery of a certain company B as follows:-
(28.9, 15.2, 28.9, 72.5, 48.5, 52.4, 37.6, 49.5, 62.1, 54.5)

Solution: H_0 = median = 63
H_1 = median ≠ 63

→ x = c(28.9, 15.2, 28.9, 72.5, 48.5, 52.4, 37.6,
49.5, 62.1, 54.5)

```
>> sp = len(which(x<63))
>> sp = len(which(x=63))
>> n = sn + sp
>> qbinom = (0.05, n, 0.5)
2
>> sn
9
>> pbinom (sn, n, 0.5)
0.9990204
```

→ H_0 is accepted.

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Q.2] The following data gives the weight of 40 students in random samples :-

46, 49, 57, 64, 46, 67, 54, 48, 69, 61, 57, 54, 50, 48, 65, 61, 66, 54, 50, 48, 49, 63, 47, 49, 47, 55, 59, 63, 53, 56, 67, 49, 60, 69, 53, 50, 48, 51, 52, 54

Use the sin test to test whether the mean weight of population is 50 kg's against the alternative that it is greater than 50 kg's.

<u>Solution:</u> H_0 = median = 50

H_1 = median = 50

```
>>> x = c(46, 49, 57, 64, 46, 67, 54, 48, 69,
          61, 57, 54, 50, 48, 65, 61, 66, 54, 54, 50,
          48, 49, 63, 42, 49, 47, 54, 59, 63, 63,
          67, 56, 49, 56, 49, 60, 4864, 53, 50,
          48, 51, 52, 54)

>>> Sn = length (x [x<50])
    Sp = length (x [x<250])
    n = Sp + Sn
>>> abinom (0.05, n, 05)
    14

>>> Sn
    13
```

So, SA is rejected Ho

Ho is Rejected

Q.3] The median age of tourist visting the certai place is clamied to be 41 years a random sample as 17 tourist have the age 25,29, 52, 48, 57, 39, 43, 36, 30, 49, 28, 39, 44, 63

Solution: H_0 = median = 41

H_1 = median ≠ 41

```
>>> x = c(25, 29, 52, 48, 57, 39, 45, 36, 60, 30, 49,
      28, 38, 44, 63, 32, 65, 42)
>>> Sn = len(which(x > 41))
>>> Sn = len(which(x < 41))
    qbinom(0.05, n, 0.5)

>>> n
>>> Sn
    8
```

→ qbinom < Sn H_0 is accepted.
median = 41 is Accepted.

) The time in minute that a patient has to wait for consultant is recorded as follows 15, 17, 24, 25, 20, 21, 32, 28, 12, 25, 24, 66 will coxn sin text to check whether the median wait in time is more that 20 minutes at 5% level as significance

Solution: H_0 = median > 20

H_1 = median < 20

>> x = c.(15, 17, 24, 25, 20, 21, 32, 72, 26, 24, 26)

>> wil.cox text.(x.alternative = 'less')

0.999

→ Accept H_0

5) The weight in kg's of the person before and after he stop smoking

Before	After
65	72
75	82
75	72
62	66
72	73

Use the wilcoxn test to check whether the wei of person in crrcses after stopping 51the smoking the 5%. level of significance.

Solution: Ho = weight increased
H1 = weight dont change.

```
>>> a = c (65, 75, 75, 62, 72)
>>> b= c. (72, 82, 72, 66, 73)
>>> a.6 - a
>>> x
-7, -7, 3, -4, -1
```

```
>>> wil.cox.test (α, mu=0)
```

~~>> a.6-a~~

~~>>> x~~

~~7, -7, 3, -4, -1~~

```
>>> wil.coxtest (x, mu =0)
>>> p.value = 0.1756
```

~~>> wit.~~

Pair value > 0.05

→ Accept Ho

Practical No. 9

ANOVA

1) The following data given the effect of treatments test the hypothesis that they have the same effect.

Solution:

H_0 : Treatment are equally effective

H_1 : Treatment are not equally effective

```
> a = c(2,3,7,2,6)
> b = c(10,8,7,5,10)
> c = c(10,13,14,13,15)
> d = data.frame(a,b,c)
> e = stack(d)
> oneway.test(values~ind, data=e)
```

P value = 0.0006232

∴ This is enough evidence to reject H_0.

2) The lifecycle of different brands of types in given
Test whether the driving life of all the tyre is rare :

→ H_0 = life all brands of tyres is same.
H_1 = life of all brands of tyres is not same.

```
a = c (20, 23, 18, 11, 17, 22, 24).
b = c( 19, 15, 11, 20, 16, 17)
c = c(21, 29, 22, 17, 20)
d = c(15, 14, 16, 18, 14, 16)
m = list (a, b, c, d)
n = stack (m)
m = list (P=a , q=b , r=c , d=d )
m =
e = stack(m)
e
oneway - test (valle ind, data = e, var.equal=TRUE)
```

p.Pvalue = 0.00007
Reject H_0

There types of mea is applied for the protection of case and no. of days of protection were noted test whether there are equally effective.

Ho : equally effective.
H1: not equally effective

a = c(99, 45, 46, 47, 48, 49)
b = c(90, 92, 51, 52, 55)
c = c(50, 53, 58, 59)
m = list.(R=a, a=b, r=c)
m
e = stack(m)
e
oneway test (values~ind, data = e)
P. value = 0.03225
reject Ho

4) An experiment was conducted 8 person and observation were noted. 56 Test the hypothesis that all groups have equal results on their health.

H_0 = equal results as their health

H_1 = not equal results

a = c(23, 26, 51, 48, 58, 37, 29, 44)

b = c(22, 27, 29, 39, 46, 48, 49, 65)

c = c(59, 66, 38, 49, 56, 62)

d = data.frame(a, b, c)

d = as.matrix(d)

e = stack(e)

e

aov(value ~ ind, data = e)

oneway.test(value ~ ind, data = e)

P value = 0.01633

Reject H_0.