Exam Seat No.________

THAKUR COLLEGE OF SCIENCE & COMMERCE

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CERTIFICATE

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Head of Department

Date : 27.2.20

Examiner

No. 1. 2. 3. 4. 5. 6. 7. 8. 9.

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Semester 2.

Semester 2 :

Practical 1:

→ R Software:

1. R is a software for statistical analysysis and data computing.

2. It is an effective data handling sofware and outcome storage is possible.

3. It is capable of graphical display.

4. It is a free software.

(Q.) Solve the following:-

① $4+6+8 \div 2 - 5$

\> 4+6 + 8 / 2 - 5

\> 9

② $2^2 + |-3| + \sqrt{45}$

\> 2^2 + |-3| + sqrt(45)

\> 13.7082

③ $5^3 + 7 \times 5 \times 8 + 46 \% 5$

→ 5^3 + 7 * 5 * 8 + 46 / 5

→ 414.2

④ roundoff $(46 \div 7 + 9 \times 8)$

\> round (46/7 + 9*8)

\> 79

(Q2) Solve:-

(i) > c(2, 3, 5, 7) * 2	→	[1] 4, 6, 10, 14
(ii) > c(2, 3, 5, 7) * c(2,3)	→	[1] 4, 9, 10, 21
(iii) > c(2, 3, 5, 7) * c(2,3,6,2)	→	[1] 4, 9, 30, 14
(iv) > c(1, 6, 2, 3) * c(-2, -3, -4, -1)	→	[1] -2, -18, -8, -3
(v) > c(2,3, 5, 7) ^ 2	→	[1] 4, 9, 25, 49
(vi) > c(4, 6, 8, 9, 4, 5) ^ c(1, 2, 3)	→	[1] 4, 36, 512, 9, 16, 125
(vii) > c(6, 2, 7, 5) / c(4, 5)	→	[1] 1.50, 0.40, 1.75, 1.00

(Q3) Solve:

(1) > x = 20

> y = 30

> z = 2

> x ^ 2 + y ^ 3 + z

[1] 27402

(2) $\sqrt{x^2+y}$

> sqrt (x^2 + y)

[1] 20.73644

(3) $x^z + y^z$

x^z + y^z

[1] 1300

x	[1]	[2]	[3]
[1,]	4	-2	6
[2,]	7	0	7
[3,]	9	-5	3

(Q4) Solve :-

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

> x <- matrix x (nrow = 4, ncol = 2, data = c(1:8))

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

(2) $x = \begin{bmatrix} 4 & -2 & 6 \\ 7 & 0 & 7 \\ 9 & -5 & 3 \end{bmatrix}$ $y = \begin{bmatrix} 10 & -5 & \ldots \\ 12 & -4 & \ldots \\ 15 & -6 & \ldots \end{bmatrix}$

> x = matrix (nrow = 3, ncol = 3,
data = c(4, 7, 9, -2, 0, -5, ...

> y = matrix (nrow = 3, ncol = 3
data = c(10, 12, 15, -5, -4, ...
7, 9, 5)

(V) Points ...
as follo...

Data :-
47, ...

> x = c(g...
> length (x...
> a = cut (...
> b = table ...
> c = transfo...
> c

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

(V) Points of marks of computer Science students are as follows :-

Data :- 59, 20, 35, 24, 46, 56, 55, 45, 27, 22, 47, 58, 54, 40, 50, 32, 36, 29, 35, 39

```
> x = c(given data)
> length (x)        > [1] 20        > breaks = seq (20, 60, 5)
> a = cut (x, breaks, right = FALSE)
> b = table (a)
> c = transform (b)
> c
```

	x	Freq
1	[20,25)	3
2	[25, 30)	2
3	[30, 35)	1
4	[35, 40)	4
5	[40, 45)	1
6	[45, 50)	3
7	[50, 55)	2
8	[55, 60)	4

AB 5-12-19

(1)>prob=c(0.1, 0.2, -0.5, 0.4, 0.3, 0.5)
>sum(prob)
[1] 1.0

(2) >p =c (0.2, 0.2, 0.3, 0.2, 0.2)
> sum (P)
(1) 1.0

(3) p= c (0.2 ,0.2, 0.35 ,0.15, 0.1)
sum (P)
[1] 1.0

:Practical 2:

Probability Distribution.

(1) Check whether the followings are pmf or not

(i)

x	$P(x)$
0	0.1
1	0.2
2	-0.5
3	0.4
4	0.3
5	0.5

(ii)

x	$P(x)$
1	0.2
2	0.2
3	0.3
4	0.2
5	0.2

(iii)

x	$P(x)$
10	0.2
20	0.2
30	0.35
40	0.15
50	0.1

(iii) I satisfies both the conditions. It is a pmf.

(i) $P(2) = -0.5$
cannot be a probability m.f since pmf is (>0) for all x.

(ii) It cannot be a probability mass fn, as summation pmf = 1.

Q&Q:

(2)

(i) Find cdf for the following pmf & stage the graph:

(i)

x	10	20	30	40	50
$P(x)$	.2	.2	.35	.15	.1

(ii)

x	1	2	3	4	5	6
$P(x)$	0.15	0.25	0.1	0.2	0.2	0.1

(i) > $P(X) = 0 \qquad x < 10$

$= 0.2 \qquad 10 \le x < 20$

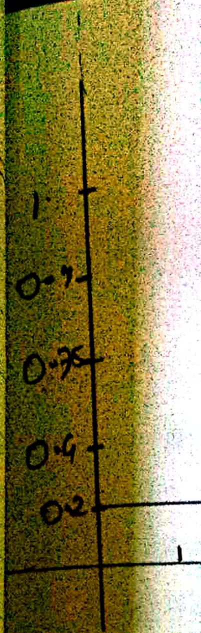
$= 0.4 \qquad 20 \le x < 30$

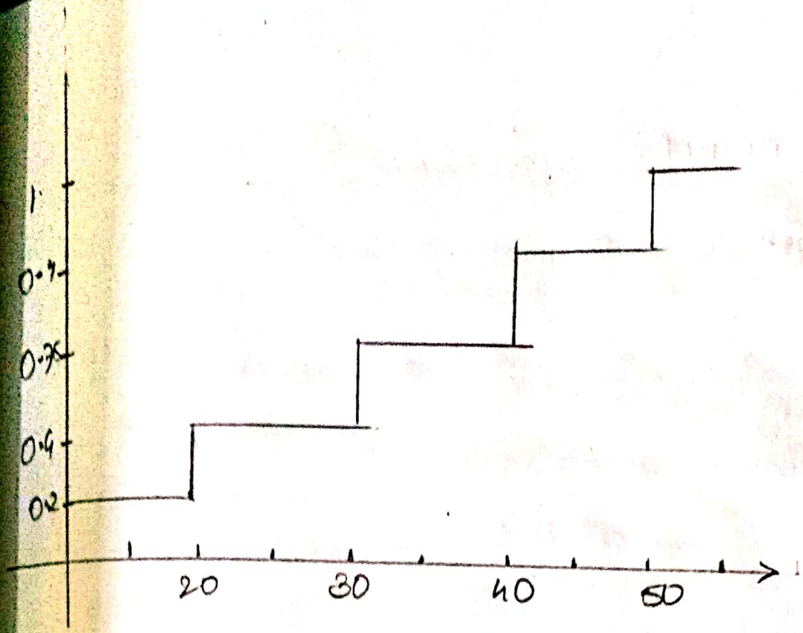
$= 0.75 \qquad 30 \le x < 40$

$= 0.9 \qquad 40 \le x < 50$

$= 1.0 \qquad x \ge 50$

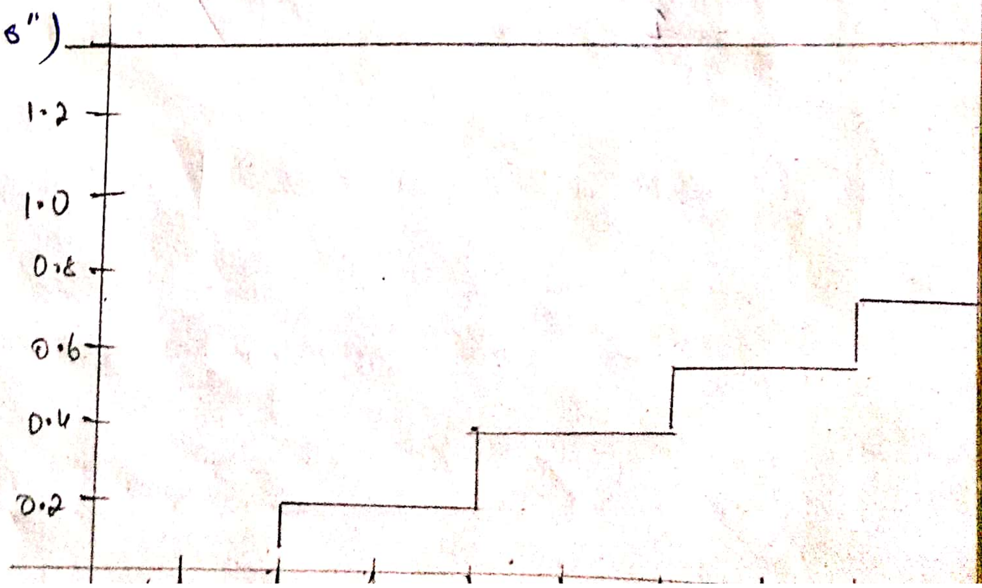
```
> p = c(0.2, 0.2, 0.35, 0.15, 0.1)
> sum(p)
[1] 1
> cumsum(p)
[1] 0.20  0.4   0.75   0.9   1.00
> pi = c(20,30, 40,50)
> plot(pi, cumsum(p), "s")
```





(ii) > P(x) = 0.15   x<1
0.25   1 ≤ x < 2
0.1   2 ≤ x < 3
0.2   3 ≤ x < 4
0.2   4 ≤ x < 5
0.1   5 ≤ x < 6

```
> p = c(0.15, 0.25, 0.1, 0.2, 0.2, 0.1)
> sum(p)
[1]  1
> cumsum(p)
[1] 0.15  0.40  0.5  0.7  0.9  1.0
> pi = (1, 2, 3, 4, 5, 6)
> plot(pi, cumsum(p), "s")
```



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Q.III Check whether foll is pdf or not:

$f(x) = 3-2x \qquad 0 \le x \le 1$

$f(x) \cdot 3x^2 \qquad 0 < x < 1$

(i) $f(x) = 3-2x \qquad 0 \le x \le 1$

$= \int_0^1 (3-2x)\,dx$

$= \int_0^1 3dx - \int_0^1 2x dx$

$= 3[x]_0 - \cancel{2}\dfrac{[x^2]_0^1}{\cancel{2}}$

$= 3-1 = 2$

(ii) $f(x) = 3x^2. \qquad 0 < x < 1$

$= \int_0^1 3x^2\,dx$

$= \dfrac{\cancel{3}[x^3]_0^1}{\cancel{3}}$

$= 1^3 - 1\mathbf{0}$

$= 1$

AM

Practical 3:

Binomial Distribution

① Find the probability of exactly 10 success in 100 trials with $p = 0.1$

② Suppose there are 12 MCQs, Each question has 5 options out of which 1 is correct, find the probability

① of having exactly 4 correct Answers.

② Atmost 4 correct answers.

③ More than 5 correct answers.

③ Find complete distribution when $n = 5$ & $p = 0.1$

④ $n = 12$

$p = 0.25$

find:

① $p(x = 5)$

② $p(x \leq 5)$

③ $p(x > 7)$

④ $p(5 < x < 7)$

Ans:

Q1) > dbinom (10, 100, 0.1)

[1] 0.1318653

Q2)

(i) > dbinom(4, 12, 0.2) [1] 0.1328756

(ii) > pbinom (4, 12, 0.2) [1] 0.927445

(iii) > 1 - pbinom (5, 12, 0.2)
[1] 0.01940528

3) > dbinom (0:5, 5, 0.1)
[1] 0.59049 0.32805 0.07290
0.00810 0.00045 0.00001

4) (1) > dbinom (5, 12, 0.25)
[1] 0.1032414

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

(3) > 1 - pbinom (7, 12, 0.25)
[1] 0.00278151

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

(5) the probability of a sales man making sell to a customer is ...
Find the probability of
① No sale out of 10 customer.
② More than 3 sale out of 20 customer.

(6) A saleman of 20% of making a sale to a customer out of 30 customer, what minimum no. sale he can make 88% p...

(7) X follows binomial distr. with n=10, p=0.3, plot the graph of pmf of cdf.

Soln
(i) > dbin...
[1] 0...
(ii) > 1- ...
[1] 0...
0.6 > ...
[1]
(7) > n = ...
> p = ...
> x = ...
> prob...
> cump...
> d = d...
> print...
> plot...
> plot ...

Soln

(i) > dbinom (0, 10, 0.15)

[1] 0.1968744

(ii) > 1- pbinom (3, 20, 0.15)

[1] 0.3522748

Q.6 > qbinom (0.88, 30, 0.2)

[1] 9

Q.7 > n=10

> p = 0.3

> x = 0:n

> prob = dbinom (x, n, p)

> cumprob = pbinom (x, n, p)

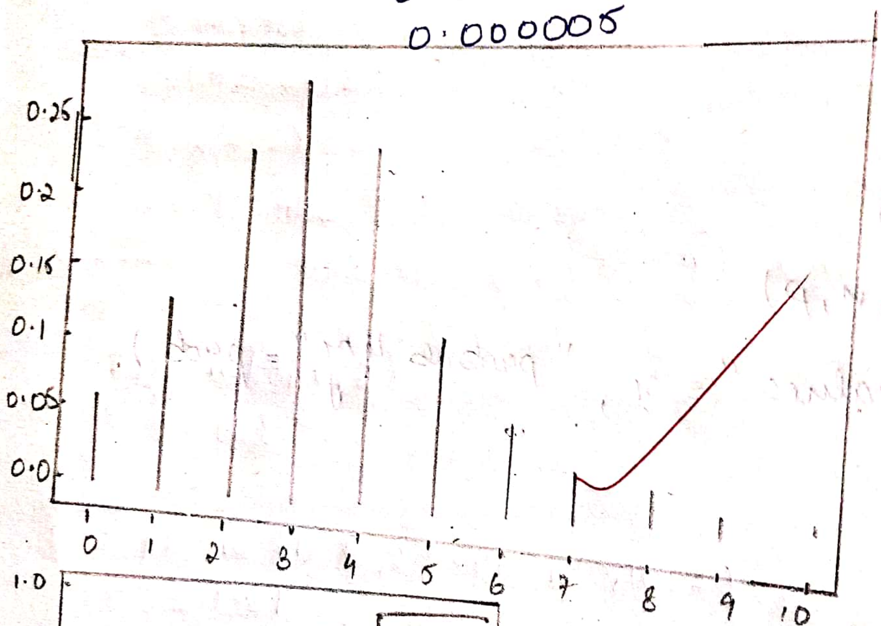
> d= data frame ("x values" = x, "probability" = prob)

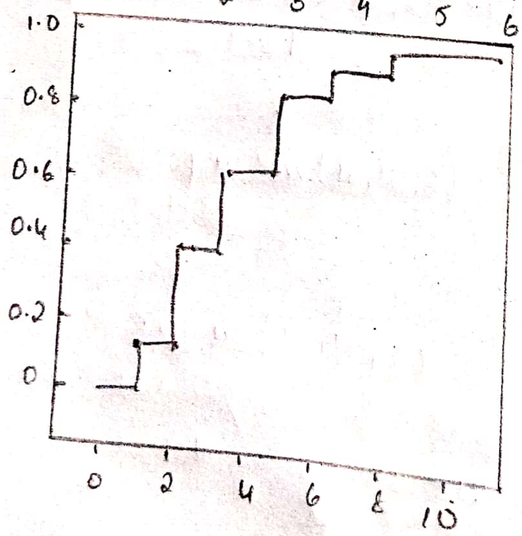
> print (d)

> plot (x, prob, "h")

> plot (x, cumprob, "s")

	x values	probability
1	0	0.0282
2	1	0.1210
3	2	0.2334
4	3	0.2668
5	4	0.2001
6	5	0.1029
7	6	0.367
8	7	0.009
9	8	0.001
10	9	0.0001
11	10	0.000005





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:Practical No:4:

Normal Distribution

* Formulas:-

$P(x=x) = dnorm(x, u, 5)$

$P(x \le x) = pnorm(x, u, 5)$

$P(x > x) = 1 - pnorm(x, u, 5)$

To generate random no. r code → rnorm(n, u, 5)

Q A random variable x follows normal distribution with mean $u = 12$, SD = 6 = 3 : find (i) $P(x \le 15)$ (ii) $P(10 \le x \le 13)$ (iii) $P(x>14)$ ~~(iv) P(x>14)~~ (iv) generate 5obs (rand no)

```
>p1 = pnorm(15,12,3)
>p1
> 0.8413447

>p2= pnorm(13,12,3) - pnorm(10,12,3)
>p2
> 0.3780661
```

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>p3 = 1 - pnorm (14,12,3)
>p3
> 0.2524925

> rnorm (5, 12, 3)
[1] 8.825718 13.798845 11.05 8683 15.467502

2\. X follows ND with $\mu = 10$, $\sigma = 2$; find:
(i) $P(x < 7)$
$P(5 \le x < 12)$
$P(x > 12)$
gen 10 obs
(v) find k such that $P(x < k) = 0.4$

>pnorm(7,10,2)
> 0.0668

> pnorm (12,10,2) - pnorm (5,10,2)
0.8351361

>1- pnorm (12,10,2)
0.1586

> rnorm (10,10,2)
10.805 11.238 8.444
13.06 11.512 8.047 6.38
11.55 13.01 11.02

>qnorm (0.4,10,2)
9.493306

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(3) Generate 5 random nu. from ND with $\mu = 15$, $\sigma = 4$ find Sample mean, median, SD & print it.

(4) x follows normal i.e $x \sim N(30, 100)$ $\mu = 30$, $\sigma = 10$, find

(i) $P(x \le 40)$ (ii) $P(x \ge 35)$ (iii) $P(25 < x < 35)$

(iv) find x such that $P(x < k) = 0.6$

(4) Code :-

```
> pnorm (40,30,10)
0.841
> 1-pnorm (35,30,10)
0.3085
> pnorm (35, 30,10) - pnorm (25, 30, 10)
0.3829
> qnorm (0.6, 30, 10)
32.53347
```

(3) Code:-

```
x = rnorm (5, 15, 4)
x
14.295    16.433    14.205    19.332    11.389

am = mean (x)
am
15.309

me = median (x)
me
14.2984
```

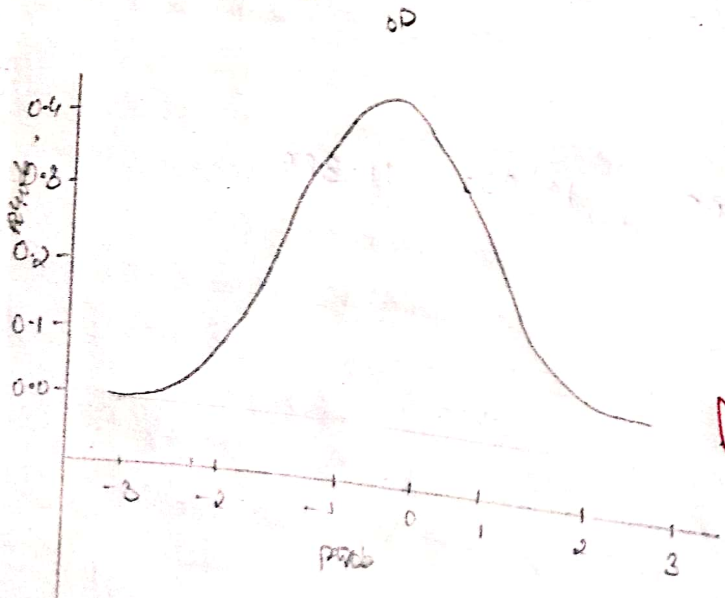
1.80.

```
>n = 5
>variance =(n-1) * var (x)/n
>variance
[1] 6.967

> sd= sqrt (variance)
> sd
[1]  2.63929
>cat ("SM ",am )
>8415.30922
> cat (" SM ", me)
 SM    14.29548
> cat ("SD", sd)
   SD  2.639
```

⑤ Plot standard normal graph

```
> x = seq (-3, 3 , by = 0.1 )
> y = dnorm (x)
> plot (x, y , xlab = "x" , ylab = " prob " , main = "sd" )
```



: Practical 5 :

: Normal & T-Test :

1. Test the hypothesis $H_0: \mu = 15$ against $H_1: \mu \neq 15$. Random sample of size 400, is drawn, and it is calculated the sample mean is 14, std dev is 3; test the hypothesis at 5% level of significance

formula:

$$\left[z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} \right]$$

<code>

```
> mo = 15 ; mx = 14 ; sd = 3 ; n=400
> zcal = (mx-mo)/(sd/sqrt(n))
> zcal
[1] -6.666
> cat ("calc value at z = ", zcal)
> calc value at z = -6.666667
> pvalue = 1-pnorm (1-abs (zcal))
  2*(1-pnorm(abs(zcal)))
[1] 2.616796e-11
```

</code>

[if pvalue < 0.05 then Hp = wrong.
if pvalue > 0.05 the Hp = Right.]

Ans: Since pvalue < 0.5, we do not accept $H_0: \mu = 15$.

2. Test the $H_0: \mu = 10$ against $H_1: \mu \neq 10$, random sample of size = 400, with sample mean 10.2, & SD = 2.25, test the hypothesis at 5% level of significance.

<code>

```
> mo = 10 , mx = 10.2 , sd = 2.25 , n = 400
> zcal = (mx - mo) /(sd /sqrt (n))
> pvalue = 2* (1 -pnorm (abs (zcal)))
> pvalue
[1] 0.075
```

</code>

Ans: Since pvalue > 0.5, we accept $H_0: \mu = 10$

3. Test the hypothesis $H_0: \mu = 0.2$ proportion of smokers in a city is 0.2, a sample is collected & the sample proportion is calc as 0.125 test the hypo at 5% level of significance, sample size = 400.

```
> n=400, P=0.2 ; p=0.125 ; Q=1-P
> zcal=((p-P)/sqrt(P*Q/n))
[1] -3.75
> pvalue =(2*(1-pnorm(abs(zcal))))
> pvalue
[1] 0.00017
```

Ans; Since pvalue < 0.05, we do not accept, $H_0: \mu = 0.2$

4. Last Year, the farmer loss = 20%, a random sample = 60 fields are collected and it is found that 9 fields crops are polluted, test hypo at 1% level of significance.

```
> P=0.2   p=9/60   , n=60   , Q=1-P
> zcal=((p-P)/sqrt(P*Q/n))
> pvalue=(2*(1-pnorm(abs(zcal))))
> pvalue
[1] 0.3329
```

Ans. Since pvalue > 0.01, we do accept H_0: 20%.

5. Test the hypothesis $H_0: \mu = 12.5$, from the following sample at 5% level of significance if the sample size > 30 - real. < 30 - c

```
> x = c(12.25, 11.97, 12.15, 12.08, 12.31, 12.28, 11.94, 11.89, 12.16,
  12.04)
> n = length(x)
> mx = mean (x)
> variance = (n-1)* var(x) / n
> sd = sqrt(variance)
> mo = 12.5
> t = (mx-mo) / (sd / sqrt(n))
pvalue = 2* (1-pnorm(abs(t)))
> p
```

Ans ;

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: Practical 6 :

Testing Proportion

① Let the population mean (the amount spent per customer in a restaurant) is 250 a sample of 100 customers selected. the sample mean is calculated as 275 & SD 30, test the hypothesis that the population mean is 250 or not at 5% level of significance.

② In a random sample of 1000 students, it is found that 750 use blue pen, test the hypothesis that the population proportion is 0.8 at 1% level of significance.

Ans:

① > mx = 275, mo = 250, sd = 30, n = 100

> zcal = (mx - mo) / (sd / sqrt (n))

> zcal

8.333

> pvalue = 2 * (1 - pnorm (abs(zcal)))

0

Since, less than <0.5%, we donot accept.

Ans:

② P = 0.8 ; Q = 1 - P ; p = 750/1000 ; n = 1000

> zcal = ((p - P) / sqrt (P * Q / n))

-3.952847

> pvalue = ((2 * (1 - pnorm (abs (zcal)))

> 7.722 68 e -05

Ans: since <0.01 we donot accept.

083

(3) 2 random sample of size 1000 & 2000 are drawn from a population with the same standard deviation 2.5, the sample mean are 67.5 & 68.0 resp, test the hypo $H_0 : \mu_1 \neq \mu_2$ at 5% level of significance.

(4) A study of noise level in 2 hospital is given below, test the claim that the 2 hospitals have same level of noise at 1% level of significance.

(5) In a sample of 600 student in a clg, 400 use blue ink, in another college from a sample of 900 students 450 use blue ink; test the hypothesis that the proportion of students using blue ink in 2 colleges are equal or not at 1% level of significance.

Soln

(3) > n1 = 1000 ; n2 = 2000 ; mn1 = 67.5 ; mn2 = 68.0 ; sd1 = 2.5 ; sd2 = 2.5

> zcal = (mn - mn2) / sqrt((sd1 ^ 2/n1) + (sd2 ^ 2/n2))

> cat ("zcal : ", zcal)

> zcal : −5.163978

> pvalue (2 * (1 - pnorm (abs(zcal))))

> 2.417564e−07.

We do not agree α 0.05.

(4) HOS A

size 84

mean 61.2

s.d 7.9

> n1 = 84 ; n2 =

> zcal = (mn1 -

> zcal

> 1.160943

> pval = (2 *

> pval

0.2423

> Since > 0.1, we

(5) n1 = 600 ;

p = (n1

q = 1 − p

zcal = (p1

> ~~0.01772~~

6.381534

pval = (2

pval

1.75 3222

Since < 0.5 ; w

(4)

	HOS A	HOS B
size	84	34
mean	61.2	59.4
s.D	7.9	7.5

> n1 = 84 ; n2 = 34 ; mn1 = 61.2 ; mn2 = 59.4 ; sd1 = 7.9 ; sd2 = 7.5
> zcal = (mn1 - mn2) / sqrt ((sd1 ^2 / n1) + (sd2 ^2 / n2))
> zcal
> 1.160943
> pval = (2 * (1 - pnorm (abs (zcal)))
> pval
> 0.2423
> since > 0.1 , we accept.

(5) n1 = 600 ; n2 = 900 ; p1 = 400/600 ; p2 = 450/900 ;
p = (n1 * p1 + n2 * p2) /(n1 + n2)
q = 1 - p
zcal = (p1 - p2) / sqrt((p * q) * (1/n1 + 1/n2))
> ~~0.01772648~~
> 6.381534
> pval = (2 * (1 - pnorm (abs (zcal)))
> pval
> 1.753222e-10
> since < 0.5 ; we do not accept.

⑥

For sample size, 880

n1=200 ; n2=200 ;

p1=44/200 ; p2=30/200 ; test 5% level of significance.

Soln

```
> n1=200 ; n2=200; p1=44/200 ; p2=30/200
> zcal=(p1-p2)/sqrt((p*q)*(1/n1+1/n2))
> zcal
[1] 1.802442
> pval=(2*(1-pnorm(abs(zcal))))
> 0.1577696 0.07
```

Since ~~x~~0.5; we do not accept.

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: Practical 7:

Small Sample Test

1. The marks of 10 students are given by 63, 66, 67, 63, 68, 69, 70, 70, 71, 72. Test the hypothesis that the sample comp comes from opposition that sample with average 66.

$H_0 \cdot \mu = 66$

```
> x = c(...data...)
> t.test(x)
        One sample t-test
data: x
t = 68.319, df = 9, p-value = 1.558e-13
alternate hyp: Here mean is not equal to 0
95 % confidence interval:
66.65171    70.14829
Sample Estimate
mean of x
    67.9
```

As 1.558e^-13 < 0.05, we reject it

```
> pvalue = 1.558e-13
> if (pvalue > 0.05) {cat("accept H0")} else {cat("Reject")}
reject H0
```

2. 2 groups of students scored the following marks. Test the hypo that there is no significant difference b/w 2 grp

```
> G1 - 18, 22, 21, 17, 20, 17, 23, 20, 22, 21
> G2 - 16, 20, 14, 21, 20, 18, 13, 15, 17, 21
```

$H_0 \to$ no difference in b/w groups.

```
> x = c(G1)
> y = c(G2)
```

> t.test (x,y)

Watch Two sample t.test

data: x & y

t-2.2573 ; df = 16.376 ; pvalue = 0.03798

alternate hyp: true difference in mean is ≠ = 95%

conf. interval:

0.1628205 5.0371795

Sample Estimate

mean of x mean of y

20.1 17.5

> pvalue = 0.03798

> if (pvalue > 0.05) { } else { }.

> Reject Ho.

3. The Sales data of 6 shops befor & after a special campaign given below:

Before - 53, 28, 31, 48, 50, 42

After - 58, 29, 30, 55, 56, 45

Test the hypothesis that campaign is effective or not, Ho no significant diff.

x = c(Before)

y = c(After)

t test (x,y, paired = T, alternative = "greater")

Paired t-test:

data: x & y.

t = -0.7815 , df = 5 , pvalue = 0.9806 .

Alt . hypo : true diff in means > than 0 .

95% confidence interval :

(-6.035547 , Inf) .

Sample Estimates .

> pvalue = 0.9806 .

> if (pvalue > 0.05) { cat ("accept") } else { cat ("reject") } .

> Accept .

4) Two medicines are applied to 2 groups of patient respectively

Ho →

GRP 1 → 10 , 12 , 13 , 11 , 14

GRP 2 → 8 , 9 , 12 , 14 , 15 , 10 , 9 .

Is there any diff . b/w 2 elements ?

5) foll are weight before & After a diet prg .

Is there a diff ?

Before = 120 , ~~125~~ , 115 , 130 , 123 , 119

After : 100 , 114 , 95 , 90 , 115 , 99

Ho → No difference b/w 2 groups .

x = c (Before)

y = c (After)

t.test (x, y)

pvalue = 0.4406

if (pvalue > 0.05) { cat ("A") } else { cat ("R") }

Accept Ho .

$H_0 \rightarrow$ No difference b/w Before & After.

Answer

⑥ > x = c (120, 125, 115, 130, 123, 119)

> y = c (100, 114, 95, 90, 115, 99)

> t.test (x, y, paired = T, alternative = "less")

> p.value = 0.9963.

> if (pvalue > 0.05) { cat ("accept") } else { cat(

Accept H_0.

AM 6.2.20

FYCS Practical 8
Large and Small Sample tests

Q.1 The arithmetic mean of a sample of 100 items from a large population is 52. If the standard is 7, test the hypothesis that the population mean is 55 against the alternative it is more than 55 at 5% LOS.

Q.2 In a big city 350 out of 700 males are found to be smokers. Ddoes the information supports that exactly half of the males in the city are smokers ? Test at 1% LOS.

Q.3 Thousand article from a factory:A are found to have 2% defectives ,1500 atricles from a 2nd factory:B are found to have 1% defective. Test at 5% LOS that the two factory are similar are not.

Q.4. A sample of size 400 was drawn at a sample mean is 99. Test at 5% LOS that the sample comes from a population with mean 100 and variance 64.

Q.5. The flower stems are selected and the heights are found to be(cm) 63,63,68,69,71,71,72 test the hypothesis that the mean height is 66 or not at 1% LOS.

Q.6. Two random samples were drawn from 2 normal populations and there values are A-66,67,75,76,82,84,88,90,92 B-64,66,74,78,82,85,87,92,93,95,97. Test whether the population have the same variance at 5% LOS.

7. A company producing light bulbs finds that mean life span of the population of bulbs is 1200 hours with s.d. 125. A sample of 100 bulbs have mean 1150 hours. Test whether the difference between population and sample mean is significantly different?

8. From each of two consignments of apples, a sample of size 200 is drawn and number of bad apples are counted. Test whether the proportion of rotton apples in two assignments are significantly different at 1 % LOS.?

	Sample size	No. of bad apples
Consignment 1	200	44
Consignment 2	300	56

Answer:

Ho:

042

Q1. > n=100 (Ho : u=55) (H1 : u ≠ 55)

mx = 52

mo = 55

sd = 7

zcal = (mx-mo) / ((sd / sqrt(n)))

pvalue = 2* (1-pnorm (abs (zcal)))

zcal = -4.285714

pvalue : 1.82153e-05

Ans: Since less than 0.05, we dont accept Ho

Q2. H_0 : P = 0.5)(350/700)

H_1 : P ≠ 0.5

P=0.5

p=350/700

n= 700

zcal = ((p- P) / sqrt (P* Q /n))

pvalue = 2* (1-pnorm(abs(zcal)))

zcal = 0

pval = 1

Ans. Since > 0.01, we accept Ho

Q3. H_0 = P_1 = P_2

H_1 = P_1 ≠ P_2

n_1 = 1000

n_2 = 1500

P1 = 0.02

P2 = 0.01

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

q = 1-P

zcal = ((p1-p2) / (sqrt((p*q)*(1/n1 + 1/n2))))

pvalue = 2*(1-pnorm(abs(z cal)))

zcal 2.084842

pvalue . 0.03708364

Since < 0.05, we do not accept H_0

Q4. $H_0 : \mu = 99$ $H_1 : \mu = 100$

n: 400

mn: 100

mo = 99

var = 64

sd: sqrt(var)

zcal = (mn-mo) / (sd / sqrt(n))

pvalue = 2*(1-pnorm(abs(zcal)))

zcal = 2.5

pvalue: 0.01241933

since < 0.05, we donot accept H_0

Q5. $H_0 : \mu = 66$ $H_1 : \mu \neq 66$

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

t.test(x)

p value = 5.522e-09

One Sample t-test

data: x

t: 47.94, df = 6, pvalue : 5.522e-09

alt. hypo: true mean is != 0

95% confidence interval.

64.66479 71.62092

mean of x

68.14286

Q5. $H_0 : \mu = 1200$

$H_1 : \mu \neq 1200$

n=100

mx = 1150

mo = 1200

sd = 125

zcal = (mx - mo) / ((sd / sqrt(n))))

pvalue = 2 * (1-pnorm (abs(zcal)))

zcal = -4

pvalue = 6.334248e-05

Since < 0.05, we donot accept H_0

Q6. H_0: μ =

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

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

var.test (x, y)

F test to compare 2 variance

data: x & y

F = 0.70686, num df = 8, demon df = 10,

pvalue = 0.6359

alt hypo: true ratio of variance is != 1

95% confidence int:

0.1833622 3.0360393

Sample estimates

ratio of variance

0.7068567.

Since > 0.05, we accept H_0

Q8.		Consignment 1	Consignment 2
Sample	200	300
bad apple	44	56

$H_0: \mu = P_1 = P_2$ $\quad$ $H_1: \mu = P_1 \neq P_2$

n1 = 200

n2 = 300

p1 = 44/200

p2 = 56/300

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

q = 1-p

zcal = ((p1 - p2)/(sqrt((p*q)*(1/n2+1/n1)))

pvalue = 2*(1-pnorm(abs(zcal)))

zcal = 0.9128709

pvalue = 0.3613104

Since > 0.01, we accept H_0.

① Use the ...
the ho...
not.

Condition
Clean

70
80
35

Soln.

H_0: Cond...

$H_1 \neq$

n = scan

m = 3

n = 2

y = matr...

chi sq. ...

data = ...

x - squ...

Since ...

Chi Square Tests & ANOVA.

1) Use the following data to test whether the condition of the home & the condition of child are independant or not.

Condition of Home

Clean	Dirty	
70	50	Clean
80	20	Fairly clean
35	45	Dirty

} condition of child.

Soln:

H_0: Condition of home & child are independant

$H_0 \neq$

x = scan (70, 80, 35, 50, 20, 45)

m = 3

n = 2

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

chisq.test (y)

Pearsons chi-squared test

data: y

X-squared = 25.646, df = 2, p-value = 2.698e-06

Ans. Since pvalue < 0.01, we dont accept H_0.

1.10

(II) Test Ho: that vaccination & disease are independent or not

Vaccine

	All	Not All	
	70	46	All
	35	37	Not All

Disease

Ho: vacc & disease are independent

```
x=c(70,35,46,37)
m=2
n=2
y=matrix(x, nrow=m, ncol=n)
chisq.test(y).
```

Pearson's chi-sq with Yates cont. corr.

data = y

x-sq = 2.0275, df=1, pvalue = 0.1545

Since >0.01, we Accept Ho.

(III) Perform a ANOVA for the following data

ANOVA > Analysis of Variance.

Type	Observations
A	50, 52,
B	53, 55, 53
C	60, 58, 57, 56
D	52, 54, 54, 55

Soln: Means are = for A, B, C, D

```
x1 = c(50, 52)
x2 = c(53, 55, 53)
x3 = c(60, 58, 57, 56)
x4 = c(52, 54, 54, 55)
d = stack(list(b1=x1, b2=x2, b3=x3, b4=x4))
names(d)
[1] "values" "ind"
50
52   } b1
53
55
53   } b2
60
58
57
56   } b3
52
54
54
55   } b4
```

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

One way analysis of means

data: values & Ind.
F = 11.735 , num df = 3 , denom df = 9 , pvalue = 0.0012

> anova = aov (values ~ Ind , data = d)
> summary(anova)

	Df	Sum sq	Mean sq	F-value	Pr(>F)
ind	3	71.06	23.688	11.73	0.001
Residuals	9	18.17	2.019		

Signif. codes 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Ans Since < 0.001 , we reject H_0.

(IV) Foll. data gives the life of tires of 4 brands

Type	Life
A	20, 23, 18, 22, 24, 17.
B	19, 15, 17, 20, 16, 17
C	21, 19, 22, 17, 20
D	15, 14, 16, 18, 14, 16.

H_0: Average life of ABCD are equal

> x1 = c (data "A")
> x2 = c (data = B")
> x3 = c (data "C")
> x4 = c (data "D")
> d = stack (list (b1 = x1 , b2 = x2 , b3 = x3 , b4 = x4)

> One way.te
On
pvalue
Ans; Since

(V) Read f

Statistics
40
45
42
15
37
38
59
20
27
36

> oneway.test (values ~ Ind, data = d, var.equal = T)

One-way analysis of means.

pvalue: 0.001719.

Inf: Since < 0.01, we reject H_0.

Read from csv.

%load %/marks.csv

> x = read.csv ("location")

statistics	maths
40	60
45	48
42	47
15	20
37	25
38	27
59	57
20	58
27	25
36	27

> am = mean (x$statistics)

35.9

> am = mean (x$maths)

39.4

> sd = ((n-1)* var (x$statistics)/n)

> 12.32234

> Sd = ((n-1)* var (x$maths)/n)

> 15.2

> n = length (x$statistics)

10

> n = length (x$statistics.

> cor (x$statistics, x$maths)

> 0.4435442

> oneway.test (values ~ Ind, data = d, var.equal = T)

AV 20-02-20

> anova = aov (values ~ Ind, data = d)

> summary (anova)

Practical 10:

Non Parametric Test.

Following are the amounts of Sulphur oxide, emitted by a Industry in 20 days apply sing test to test the hypothesis that the population median is 21.5 at 5% LOS

17, 15, 20, 29, 19, 18, 22, 25, 27, 9, 24, 20, 17, 6, 24, 14, 15, 28, 24, 26

H_0 :

population median = 21.5

```
x = c(...)
me = 21.5
sp = length(x[x>me])
sn = length(x[x<me])
n = sp+sn
pv = pbinom(sp, n, 0.5)
pv
0.4119015
```

Since $H_0 > 0.05$, we accept H_0.

if H_1 is me ≠ or me < = pv = pbinom (sp, n, 0.5)

else pv = pbinom (sn, n, 0.5)

Q. Following is the data of 10 observation apply sign test to test hypo that the population median 625 against alternative > 625.

612, 619, 631, 628, 643, 640, 655, 649, 670, 663.

H_0 : population median 625 H_1 : me > 625

```
> x = c( . . . )
> me = 625
sp = length (x[x>me])
sn = length (x[x<me])
n = sp + sn
pv = pbinom (sn, n, 0.5)
pv
0.054
```

since > 0.05, we accept H_0.

Q. the following are, test the hypo that 048
the population median = 60 against alt > 60
at 5% LOS using Wilcoxon Signed Rank Test.

63, 65, 60, 89, 61, 71, 58, 51, 69, 62, 63, 39, 72, 69,
48, 66, 72, 63, 87, 69.

H_0: pop me = 60
H_1: ... > 60

x = c( )
wilcox.test (x, alter = "greater", mu = 60)

Wilcoxon Rank sum test with cont. corr.

data: x & mu
w = 15.5, pvalue = 0.2037
alt hyp: true location shift > 0

Since > 0.05, we accept H_0.

alter = "less"

alter = "two.sided"

SAO

Q. pm = 12 or less than 12.

15, 17, 24, 25, 20, 21, 32, 28, 12, 25, 24, 26

n = c(...)

wilcox.test (n, alter = "less", mu = 12)

W = 11.5, p-value = 0.9463

Since > 0.05, we accept H_0

WB	WA
65	72
75	74
75	72
62	66
72	73

Q weights of students, b/A stopped smoking using wsrt, test that there is no sign. chg

> wilcox

H_0 : Before and After there is no change

H_1 : there is change

x = c (65, 75, 75, 62, 72)

y = c (...)

d = x - y

mu = 0

> wilcox.test (d, alt = "two.sided", mu)

W = 2 , pvalue = 1

alt. hyp : true location shift ≠ 0

Since ~~Ho~~ pvalue > 0.05 , we accept H_0.

A.Rai
27.02.