PRACTICAL NO:- 1

AIM :- Basic of R Softwere

1) R is a Softwere for statical & data

2) It is an affective data handling Sof and outcom storage is possible.

3) It is capable of Graphical display.

4) It is a free Softwere

Q. Solve the following

1) $4+6+8\div2-5$

```
> 4+6+8/2-5
[1] 9
```

2) $2^2+|-3|+\sqrt{45}$

```
>2^2 + abs(-3) + sqrt (45)
[1] 13.7082
```

3) $5^3+7\times5\times8+46/5$

```
>5^3 + 7*5*8 + 46/5
[1] 414.2
```

4) $\sqrt{4^2+5\times3+7/6}$

```
> sqrt(4^2+5*3+7/6)
[1] 5.671567
```

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5) Round off

46 ÷ 7 + 9 × 8

>round (46 ÷ 7 + 9*8)

[1] 79

Q2 >c(2,3,5,7)*2

[1] 4 6 10 14

>(2,3,5,7)*c(2,3,6,2)

[1] 4 9 30 14

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

[1] 4 9 25 49

>c(2,3,5,7)×c(2,3)

>c(1,6,2,3)×c(-2,-3,-4,-1)

[1] -2 -18 -8 -3

>c(4,6,8,9,4,5)^c(1,2,3)

[1] 4 36 512 9 16 125

>c(6,2,7,5)/c(4,5)

[1] 1.50 0.40 1.75 1.00

Q3 >x=30 >y=30 >z=2

>x^2 + y^3 + z

[1] 27402

>sqrt (x^2 + y)

[1] 20.73644

>x^z + y^z

[1] 1300

Q.4 >X<-matrix(nrow=4, ncol=2, d=c(1,2,3,4,5,6,7,8))

>x

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

Q5 Find x+y & 2x+3y where $x = \begin{bmatrix} 4 & -2 & 6 \\ 7 & 0 & 7 \\ 9 & -5 & 3 \end{bmatrix}$

$y = \begin{bmatrix} 10 & -5 & 7 \\ 12 & -4 & 9 \\ 15 & -6 & 5 \end{bmatrix}$

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

>x

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

>y<-matrix (nrow=3, ncol=3, data=c(10,12,15,-5,-4,-6,7,9,5))

>y

	[,1]	[,2]	[,3]
[1,]	10	-5	7
[2,]	12	-4	9
[3,]	15	6	5

>x+y [,1] [,2] [,3]

7 12

No.

```
> 2* x + 3* y
      [,1]  [,2]  [,3]
[1,]   85   -19    33
[2,]   50   -12    41
[3,]   63   -28    21
```

Q.6 Marks & statics of CS Batch B

```
x = c(58, 20, 35, 46, 46, 56, 55, 45, 27, 22, 4?,
      54, 40, 50, 32, 36, 29, 35, 39)

> n = c(data)
> break = seq(20, 60, 5)
> a = cut(n, breaks, right = FALSE)
> b = table(a)
> c = Transform(b)
> c

1  [20,25]
2  [25,30]
3  [30,35]
4  [35,40]
5  [40,45]
6  [45,50]
7  [50,55]
8  [55,60]
9  [60,65]
```

1) Check whether the followings are P.m.f or not

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

If the data is P.M.F then $\sum P(x) = 1$

$\therefore P(0) + P(1) + P(2) + P(3) + P(4) + P(5) = P(x)$

$= 0.1 + 0.2 - 0.5 + 0.4 + 0.3 + 0.5$

$= 1.0$

$\because P(2) = -0.05$, it can be a probability mass function.

2)

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

The condition of P.M.F is $\sum P(x) = 1$

So,

$\sum P(x) = P(1) + P(2) + P(3) + P(4) + P(5)$

$= 0.2 + 0.2 + 0.3 + 0.2 + 0.2$

$= 1.1$

$\therefore$ The given data is not P.M.F Because the $P(x) \neq 1$

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3)

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

The condition for p.m.f is

1) $p(x) \geq 0 \;\forall x$ satisfy

2) $\sum p(x) = 1$

$\sum p(x) = p(10) + p(20) + p(30) + p(40) + p(50)$

$= 0.2 + 0.2 + 0.35 + 0.15 + 0.1$

$= 1$

$\therefore$ The given data is p.m.f

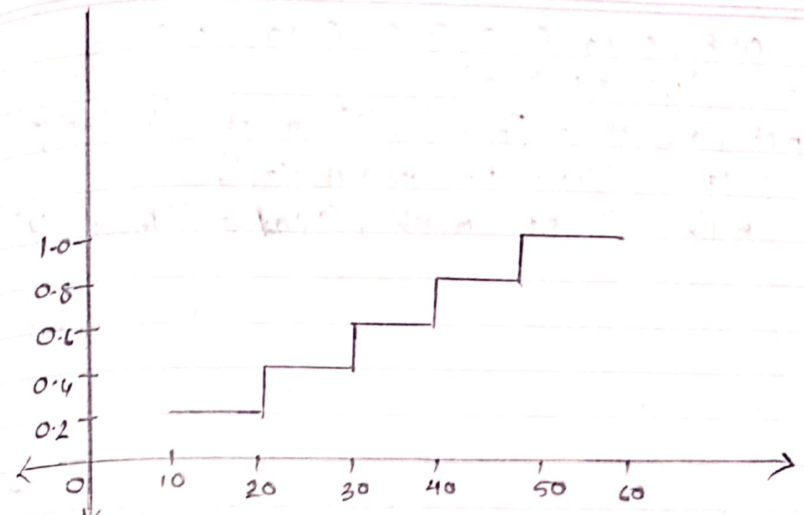
Code

```
>prob = c(0.2,0.2,0.35,0.15,0.1)
>sum(prob)
[1] 1
```

2) Find the c.d.f for the following p.m.f & sketch the Graph.

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

$P(x) = 0$	$x < 10$
0.2	$10 \leq x < 20$
0.4	$20 \leq x < 30$
0.75	$30 \leq x < 40$
0.90	$40 \leq x < 50$
1.0	




```
>x = c(10,20,30,40,50)
>plot(x, cumsum(prob), "s")
```

Q2 Find

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

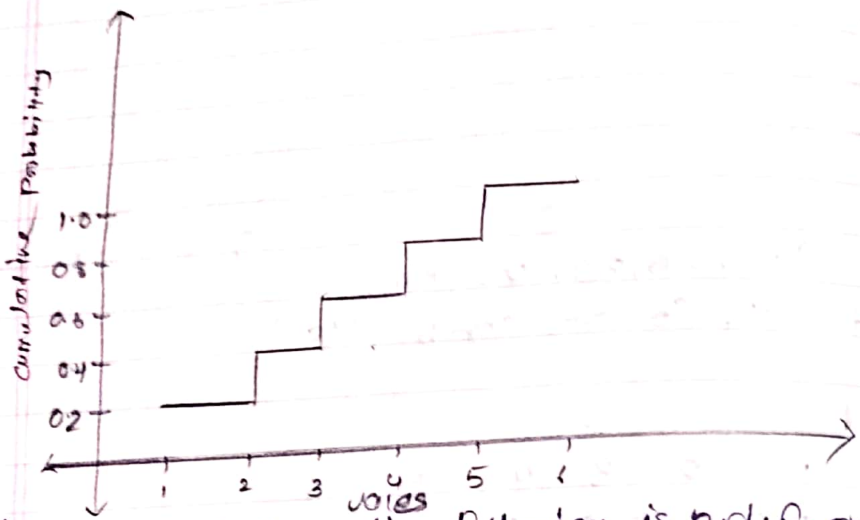
$P(x) = 0$	$x < 1$
0.15	$1 \leq x < 2$
0.40	$2 \leq x < 3$
0.50	$3 \leq x < 4$
0.70	$4 \leq x < 5$
0.90	$5 \leq x < 6$
1.00	$x \geq 6$

```
>probe = c(0.15, 0.25, 0.1, 0.2, 0.2, 0.1)
>sum(probe)
[1] 1
>cumsum(probe)
```

[1] 0.15, 0.40, 0.50, 0.10, 0.90, 1.00

> x = c(1, 2, 3, 4, 5, 6)

> plot (x, Cumsum (probe), "s" xlab = "value",
  ylab = "Cumulative probability",
  main = "CDF graph", "Col = "Brown")



3) check whether the following is p.d.f or not

(i) $f(x) = 3 - 2x$; $0 \leq x \leq 1$

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

(i) $f(x) = 3 - 2x$

$= \int_0^1 F(x)$

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

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

$= [3x - x^2]_0^1 = 2.$

$\therefore$ The ...

PRACTICAL NO:- 3

TOPIC :- Binomial distribution.

\# $P(X=x)$ = dbinom (x, n, p)
\# $P(X \le x)$ = pbinom (x, n, p)
\# $P(X > x)$ = 1-pbinom(x, n, p)
\# P(X) is unknown
\# If x is unknown
$p_1 = P(X \le x)$ = qbinom (p_1, n, p)

1) Find the probability of exactly 10 success in hundred trials with p=0.1

2) Suppose there are 12 mcq, Each question has 5 options out of which 1 is correct. Find the probability of having exactly 4 correct answer
ii) atmost 4 correct answer.
iii) more than 5 correct answers.

3) Find the complete distribution when n=5 & p=0.1

4) n=12, p=0.25 find the following probability
i) P(X=5) iii) P(X>7)
ii) P(X≤5) iv) P(5<X<7)

5) The probability a salesman to making a sale to customer, 0.15 find the probability.
i) X10 sales to customers out of making a sale to customer out of 30 customer that min

6) A salesman has 20% probability of making a sales to customer out of 30 customers that minimum number of sales he can make with 88% of probability.

7) X follows Binomial distributions with n=10, p=0.3 plot the graph of pmf & cdf

5) >dbinom (0, 10, 0.15)
[1] 0.1968744
>1-pbinom (3, 20, 0.15)
[1] 0.3522748

6) qbinom (0.88, 30, 0.2)
[1] 9

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)

	x values	probability
1	0	0.0282
2	1	0.1210
3	2	0.2334
4	3	0.2668
5	4	0.2001

02		0.1029
	5	0.0367
6	6	0.0090
7	7	0.0017
8	8	0.0001
9	9	0.0000
10	10	
11		

PRACTICAL NO: 4

AIM: Normal Distribution.

i) P(X=x) = dnorm(x, μ, σ)
ii) P(x ≤ x) = pnorm(x, μ, σ)
iii) P(x > x) = 1 - pnorm(x, μ, σ)
iv) To generate random number form a normal distribution (n random numbers) the R code is
rnorm(n, μ, σ)

Q1 A random variable X follows normal distribution with mean μ = 12 & S.D = 3 Find
i) P(X ≤ 15) ii) P(10 ≤ x ≤ 13) iii) P(x > 14)
iv) Generate 5 observation random variable

CODE:

```
> p1 = pnorm(15, 12, 3)
> p1
[1] 0.8413447
> cat("P(X <=15)=", p1)
P(X <= 15)= 0.8413447
> p2 = pnorm(13, 12, 3) - pnorm(10, 12, 3)
> p2
[1] 0.3780661
> cat("P(10<= X <=13)=", p2)
P(10<= X<= 13) = 0.3780661
> p3 = 1 - pnorm(14, 12, 3)
> p3
```

> cat("p(X>14)=" p3)
p(X>14)=0.2524925
> p4=rnorm(5,12,3)
> p4
[1] 15.254723 16.545505 11.280515 6.419944
12.272460

2) X follows normal distribution with μ=10, σ=2
Find i) p(x≤7) ii) p(5<x<12) iii) p(x>12)
iv Generate 10 observation x. find K such that
p(X<K)=0.4

CODE:
>a1 = pnorm(7,10,2)
>a1
[1] 0.668072
>a2 = pnorm(5,10,2)-pnorm(12,10,2)
>a2
[1] 0.8357361
>a3=1-pnorm(12,10,2)
>a3
[1] 0.1586553
>a4 = rnorm(10,10,2)
>a4
[1] 12.608931 9.920417 12.637741 8.073359
8.721380 9.193726 9.366824 11.707106
> a5 = qnorm(0.4,10,2)
>a5

Q3 Generate 5 Random Numbers from a Normal distribution μ=15, σ=4. Find Sample mean, median, S.D print it

CODE:
>rnorm (5,15,4)
[1] 10.7649 7.793249 9.953444 13.345904
17.509668
>am = mean(x)
> am
[1] 11.87345
>cat("Sample mean is= ",am)
Sample mean is= 11.87345
> me= median(x)
> me
[1] 10.76499
> cat("median is= ",me)
median is= 10.76499
> n=5
> v=(n-1)* var(x)/n
> v
[1] 11.09965
> S.D= sqrt(v)
> SD
[1] 3.33163
> cat ("S.D is= ",SD)
S.D is = 3.331613

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Q4 $X \sim N(30, 100)$, $\sigma = 10$

i) $P(x \le 40)$

ii) $P(x > 35)$

iii) $P(25 < x < 35)$

iiii) $P(25 < x < 35)$ Find K such that $P(X < K) = 0.6$

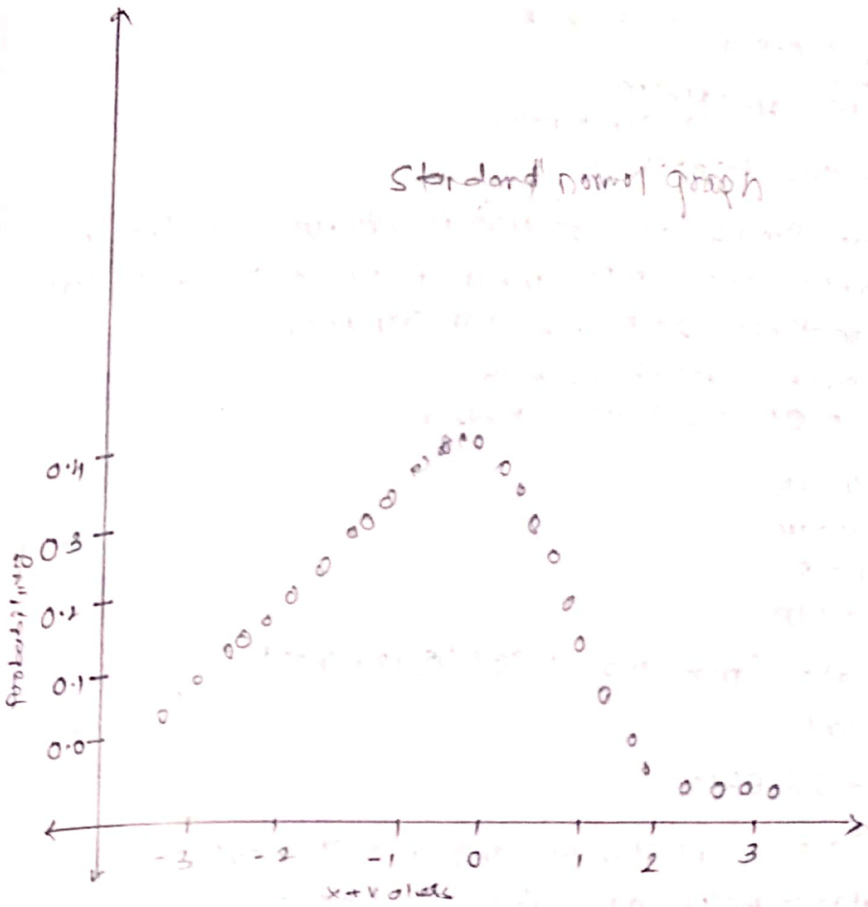
~~iv) p(25 < x < 35)~~

```
> P1 = pnorm (40, 30, 10)
> P1
[1] 0.8413447
> P2 = 1-pnorm (35, 30, 10)
> P2
[1] 0.3085375
> P3 = pnorm (25, 30, 10) - pnorm (35, 30, 10)
> P3
[1] -0.382949
> P4 = qnorm (0.6, 30, 10)
> P4
[1] 32.53347
```

Q) Plot a the standard normal Graph.

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


Standard normal graph



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PRACTICAL NO: 5

TOPIC: Normal & T-test

1) $H_0 = 15$ (null) $H_1 : \mu \neq 15$ (Alternative)

Test the hypothesis
Random sample of size 400 is drawn and it is calculated the sample mean is 14 & S.D is 3 test the hypothesis at 5% level of significance.

\# 0.05 > accept the value.
\# 0.05 < less then Reject

```
> m0=15
> mx=14
> sd=3
> n=400
> zcal= (mx-m0)/(sd/(sqrt(n)))
> zcal
[1] -6.666667
> cat("calculated value of z is =", zcal)
Calculated value of z is: -6.666667
> pvalue = 2*(1-pnorm(abs(zcal)))
> pvalue
[1] 2.616776e-11
```

∴ The value, less than 0.05 we will Reject the value of $H_0 = \mu = 15$

2) Test the hypothesis $H_0 : \mu = 10$ against $H_1 : \mu \neq 10$. A random sample size of 400 is drawn with sample mean = 10.2 & S.D = 2.25 test the hypothesis at.

```
> m0 =10
> n=400
> mx = 10.2
> SD = 2.25
> Zcal = (mx-m0)/(Sd/(sqrt(n)))
> Zcal
[1] 1.77778
> pvalue = 2* (1-pnorm(abs(zcal)))
> pvalue
[1] ~~2.616776e-11~~ 0.07544636
```

∴ The value is ~~greater~~ then 0.05 we will Reject ~~the value of $H_0 = \mu = 15$~~. ∴ The value is output

3) Test the hypothesis H_0: proportioned of smokers in college is 0.2
A sample is collected & calculated. the sample proportional & as 0.125 test the hypothesis at 5% level of significance (Sample size is 400)

```
> P=0.2
> p=0.125
> n=400
> Q=1-P
```

> cal = (p-P) / (sqrt(P* q/n))
> cat (" Calculated value of Z is = ", Zcal)
[1] Calculated value of Z is = -3.75
> pvalue = 2* (1-pnorm (abs (zcal)))
> pvalue
[1] 0.0001768346 (Reject)

4) Last year farmer lost 20% of their crops. A Random sample of 60 fields are counted & it is found that 9 fields crops are insect polluted. test the hypothesis at 1% level of significance

> p = 0.2
> p = 9/60
> n = 66
> Zcal = (p-P) / (sqrt (P* Q / n))
> Zcal
[1] - 0.9682458.
> pvalues = 2* (1-pnorm (abs(zcal)))
> pvalue
[1]. 0.~~768~~ 24583329216
∴ The value is 0.01 so values is accepted.

5) test the hypothesis Ho : μ = 12.5 from the following Sample at 5% Level of significance.
> x = c (12.75, 11.97, 12.15, 12.08, 12.31, 12.28, 11.94, 11.89, 12.16, 12.04)
> n = Length(x)
> n

PRACTICAL NO:- 6

12

AIM:- Large Sample test

1) Let the population mean (the amount spent per Customer in a Restorents) is 250. A sample of 100 Customers Selected the Sample mean is Calculated as 275 & S.D 30 test the hypothesis that the population mean is 250 or not on 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

1) Solution:-

```
> m0=250
> mx =275
> sd = 30
> n =100
> zcal= (mx-m0)/(sd/(sqrt(n)))
> cat("Calculated value of z is =", zcal)
[1] Calculated value of z is =8.33333
> pvalue = 2* (1-pnorm (abs(zcal)))
> pvalue
[1] 0
```

∴ the values of Less than 0.05 we will Reject the value of $H_0 = \mu = 250$

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5> In a Sample of 600 Students in clg 400 used Blue ink. In another clg. from a sample of 9.. student 450 use Blue ink test the hypothesis that the proportion of student using Blue ink in two collage are equal or not at 10% or Level of significance:

3

```
>n1=1000
>n2=2000
>mx1=67.5
>mx2=68
>sd1=2.5
>sd2=2.5
>zcal=(mx1-mx2)/sqrt((sd1^2/n1)+(sd2^2/n2))
>zcal
[1]-5.163978
>pvalue =2*(1-pnorm (abs (zcal)))
>pvalue
[1] 2.417564e-07 ∴ (Reject)
```

4>

```
>n1=84
>n2=34
>mx1=61.2
>mx2=59.4
>sd1=7.9
>sd2=7.5
>zcal=(mx1-mx2)/sqrt ((sd1^2/n1)+(sd2^2/n2))
>zcal
```

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6 ~~H0 =~~ $p_1 = p_2$

```
> n1=200
> n2=200
> p1=44/200
> p2=38/200
> p=(n1*p1+n2*p2)/(n1+n2)
> p
[1]0.185
> q=1-p
> q
[1]0.815
> zcal=(p1-p2)/sqrt(p*q*(1/n1+1/n2))
> zcal
[1]1.802741
> pvalue=2*(1-pnorm(abs(zcal)))
> pvalue [1] 0.0714285
```

∴ (Accepts ∴ greater then 0.05)

Q.1] The marks of 10 Student are given by: 63, 63, 66, 67, 68, 69, 70, 70, 71, 72 Test of hypothesis that the Sample Comes for a population with Average marks.

Sol:- H0 : μ = 66

```
> x = c(63, 63, 67, 66, 67, 69, 70, 70, 71, 72)
> t.test(x)
```

One Sample t-test

data: x

t = 68.319, dof = 9, pvalue = 1.558e-13

alternative hypothesis : true mean is not equal to 0 95 percentage Confedence interval:

65.65171 70.14829

Sample estimate:

mean of x

67.9

Since p-value is less than 0.05 we reject hypothesis at 5% level of Significance.

mean of x mean of y

20.1 17.5

```
> pvalue = 0.03792
> if (pvalue > 0.05) {cat ("accept H0")}
  else {cat ("reject H0")}
reject H0>
```

Since p-value is less than 0.05 we reject hypothesis at 5% level of Significance.

Q) The sales data of six shops Before And after a special Campaign are given below:
Before : 53, 28, 31, 48, 50, 42,
After : 58, 29, 30, 55, 56, 45
Test hypothesis that the Campaign is effective or not

Soln: Ho : There is no significant difference of sales before & after the Campaign

> x = c(53, 28, 31, 48, 50, 42)
> y = c(58, 29, 30, 55, 56, 45)
> t.test(x, y, paired = T, Alternative = "greater")

paired t-test

data : x & y
t = -2.7815, df = 5, pvalue = 0.9806.
alternative hypothesis : two diffence in mean is Greater than 0
95 percents Confidence interval :
-6.035547 Inf
Sample estimate
mean of difference
-3.5

> pvalue = 0.9806
> if (pvalue > 0.05) {cat("accept Ho")} else {cat("reject Ho")}
accept Ho>

Since pvalue [illegible] than 0.05 we accept hypothesis at 5% level of Significance

Q) Two medicines are applied to the two group of patients respectively
Group 1 : 10, 12, 13, 11, 14
Group 2 : 8, 9, 12, 14, 15, 10, 9
Is there any Significant difference Between two medicines

Q) The following are the weight before and after the diet program. Is the diet program effective:
Before : 120, 125, 118, 130, 123, 119
After : 100, 114, 95, 90, 115, 99

Sol: HO: There is no significance difference Between medicine of Two group
> x = c(10, 12, 13, 11, 14)
> y = c(8, 9, 12, 14, 15, 10, 9)
> t.test(x, y)

Welch two sample t-test

data : x & y
t = 0.80389, df = 9.7094, p-value = 0.4408
alternative hypothesis : true difference in mean is not equal to 0.

95 perentage Confidence interval:
-1.781171 8.781171
sample estimate
mean of x & y:
12 11
> pvalue = 0.4406
> if (pvalue > 0.05) {cat("accept H0")}
else {cat("reject H0")}
Since the pvalue is greater than 0.05 we accept the hypothesis at 5% level of significance
H0: The is nosignificants different
80/.5) > x = c(120, 125, 115, 130, 123, 119)
> y = c(100, 114, 95, 90, 115, 99)
> t.test(x,y, paired=T, alternative = "less")
paired t-test
data: x & y
df = 5, pvalue = 0.9963
t = 4.558
alternative hypothesis: true difference in mean is less the 0
95 percentage Confidence interval.
Inf 29.6295
sample the difference
12.83333

> pvalue = 0.9963
> if (pvalue > 0.05) {cat("accept H0")}
else {cat("reject H0")}
accept H0>
Since the pvalue is greater than 0.05 we accept the hypothesis at 5% level of significance

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PRACTICAL NO:- 8

1) $H_0 : \mu = 55$
$H_1 : \mu \neq 55$
> n =100
> mx = 52
> mo = 55
> sd = 7
> zcal = (mx-mo) / (sd/ (sqrt (n)))
> zcal
[1] -4.285714
> cat ("Calculated z value is = " zcal)
Calculated z value is = -4.295714
> pvalue = 2* (1-pnorm (abs (zcal)))
> pvalue
[1] 1.82153 e-05

Since pvalue is less than 0.05 we Reject the hypothesis at 5% Level of Significance

2) $H_0 : \mu$
> P=0.5
> Q =1-P
> p=350/700
> n = 700
> zcal = (p-P) / (sqrt (P*Q/n))
> cat ("Calculated z value is = ", zcal)
Calculated z value is =0
> pvalue = 2* (1- pnorm (abs(zcal)))

Since pvalue ... accepts hypothesis at 1% Level of Significance.

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3) $H_0 : P_1 = P_2$ as $H_1 : P_1 \neq P_2$
> n1 =1000
> n2 =1500
> p1 = 0.02
> p2 = 0.01
> p= (n1 * p1+n2* p2) / (n1+n2)
> p
[1] 0.014
> q = 1-p
> q
[1] 0.986
> zcal = (p1 -p2) / sqrt (p*q* (1/n1 + 1/n2))
> zcal
[1] 2.084842
> cat ("Calculated z value is = ", zcal) Calculated z value is = 2.084842
> pvalue = 2* (1- pnorm (abs (zcal)))
> pvalue
[1] 0.03708364

Since pvalue is Less than 0.05 we reject the hypothesis at 5% Level of Significance.

Q3

4) Ho : μ = 100

```
>mx=99
>mo=100
>sd=8
>n=400
>zcal=(mx-mo)/(sd/(sqrt(n)))
>zcal
[1] -2.5
>pvalue=2*(1-pnorm(abs(zcal)))
>pvalue
[1] 0.01241933
```

Since pvalue is less than 0.05 we reject the hypothesis at 5% level of significance

5) Ho : μ = 66

```
x=(63,63,68,69,71,71,72)
>t.test(x)
        One Sample t-test

data x
t= 47.94, df=6, pvalue=5.522e-09
alternative hypothesis: true mean is
 not equal to 0
95 percent Confidence interval:
   64.66479  71.62092
   Sample estimates:
   mean of x
    68.142%
```

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7) H_0 : u = 1200
```
> mo = 1200
> mx = 1150
> n = 100
> sd = 125
> zcal = (mx - mo) / (sd / (sqrt (n)))
> cat ("calculated z value is = ", zcal)
  Calculated z value is = -4
> pvalue = 2 * (1 - pnorm (abs (zcal)))
[1] 6.334248 e-05
```
Since pvalue is less than 0.05 we reject hypothesis

8) H_0 : u = $P_1 \neq P_2$
```
> n1 = 200
> n2 = 300
> p1 = 44/200
> p2 = 56/300
> p = (n1 * p1 + n2 * p2) / (n1 + n2)
> p
[1] 0.2
> q = 1 - p
> zcal = (p1 - p2) / sqrt (p * q * (1/n1 + 1/n2))
> zcal
[1] 0.9128709
> cat ("Calculated z value is = ", zcal)
Calculated z value is = 0.9128709
```

85

TOPIC:- Non-parametric testing of hypothesis using R- Environment

1. The following data represents earning (in dollars) for a Random Sample of five common stocks listed on the New York stock Exchange Test whether the median earning is 4 dollar.

Data: 1.68, 3.35 2.50, 6.23, 3.24);

> x <- c(1.68, 3.35, 2.50, 6.23, 3.24);

> n <- length(x);

> n

> [1]5

> x>4;

[1] FALSE FALSE FALSE TRUE FALSE

> s<-sum(x>4); s;

[1]1

> binom.test (s, n, p=0.5, alternative="greater")

Exact binomial test

data: s and n

numbers of successes = 1, number of trials = 5, p-value = 0.
alternative hypothesis: the probability of success is greater then 0.5, as

95 percent confidence interval:

0.01020622 1.00000000

Sample estimates:

probability of success 0.2

3. The diameter of a ball bearing was mea by 6 inspector each using two different of Callipers. The Result were, Test whe average ball Bearing for.

Inspector:	1	2	3	4	5	6
Caliper 1:	0.265	0.268	0.266	0.267	0.269	0.264
Caliper 2:	0.263	0.262	0.270	0.261	0.271	0.260

Callipers 1 & Callipers 2 are same.

CODES

```
> x <- c(0.265, 0.268, 0.266, 0.267, 0.269, 0
> y <- c(0.263, 0.262, 0.270, 0.261, 0.271, 0.2
> wilcox.test (x, y, alternative = "greater"
```

Wilcoxon rank sum test

data : x & y

W = 24, p = 0.197

alternative hypothesis : true location shift is great than 0

∴ pvalue is greater than 0.05 we accep it

4) An officers has three effective typewriter A, B & C In a ready of machine usage firm has kept Records of machine usage rate of each we machine A was out of Repair for two weeks It is interest to find out which machine has Better usage Rate. Analysis

Krushkal - wallis rank sum test

data : x & j

Kruskal - wallis chi-squared = 5.217, df = 2

pvalue = 0.07365

∴ pvalue is greater than 0.05 we accepts it

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Pearson's Chi-squared test

data : y
X-squared = 15.646
df = 2
p-value = 2.698e-06
// are dependant
∴ pvalue is less than 0.05 we reject the hypothesis at 5% level of significance

Q2 Test the hypothesis that vaccination & disease are indepents or Not

vaccine		
Disease	Affected	Not-Affected
Affect	70	46
NON-affected	35	37

H0: Disease & vaccine are idependent

```
> x = c(70, 35, 46, 37)
> m = 2
> n = 2
> y = matrix(x, nrow=m, ncol=n)
> y
      [,1]  [,2]
[1,]   70    46
[2,]   35    37
```

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aa

> d = stack (list (b1=x1, b2=x2, b3=x3, b4=x4))

> name (d)

[1] "values" "ind"

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

one-way analysis of means

data : values and ind

F = 11.755 df = 3 , denom df = 9,

pvalue = 0.00183

∴ p-value is less than 0.05 we reject the hypothesis

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

> summary (anova)

	Df	Sum	meansq	Fvalue	Pr(>F)
ind	3	71.06	27.688	11.73	0.00183**
Residuals	9	18.17	2.019		

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

Q4) Following data gives a life of tyres of 4 brands

TYPE	LIFE
A	20, 23, 18, 17, 18, 22, 24
B	19, 15, 17, 20, 16, 17
C	21, 19, 22, 17, 20
D	15, 14, 16, 18, 14, 16

Ho : The mean's of A, B, C, D are equal

> x1 = c(20, 23, 18, 17, 18, 22, 24)

> x2 = c(B)

> x3 = c(C)

> x4 = c(D)

> d = stack (list (b1=x1, b2=x2, b3=x3, b4=x4))

> names (d)

[1] "values" "ind"

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

one-way analysis of mean

data : values & ind

F= ~~value~~ 6.8445 , nom df=3 , denom df = 20

pvalue = 0.002349

∴ pvalue is less than 0.05 we reject the hypothesis

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

> Summary (anova)

	Df	Sumsq	meansq	Fvalue	Pr(>F)
ind	3	91.44	30.479	6.845	0.00235**
Residuals	20	89.06	4.453		

Signif. code : 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

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> x = read.csv("C:/user/Admin/Desktop/marks.csv")

> x

	stats	maths
1	40	60
2	45	48
3	15	47
4	37	20
5	36	05
6	49	27
7	59	57
8	20	58
9	27	25
10	42	27

> am = mean(x$stats)

> am

[1] 37

> am1 = mean(x$maths)

> am1

[1] 39.4

> m1 = median(x$stats)

> m1

> m1 = median(x$maths)

[1] 37

> n = length(x$stats)

> n

[1] 10