Practical 1

Title: Random Variable

Q1. 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	0.01
0	0.2	0	0.	0
1	0.3	0.3	0.3	0.09
2	0.4	0.8	1.6	0.64
Total	$\Sigma = 1$	$\Sigma = 1$	$\Sigma E(x)^2 = 2$	$\Sigma[E(x)]^2 = 0.74$

$\therefore$ 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 $E(x) = 1$ and variance $V(x) = 1.24$

b.

x	-1	0	1	2
$p(x)$	$1/8$	$1/8$	$1/4$	$1/2$

Solution :

x	$p(x)$	$x.p(x)$	$E(x)^2$	$[E(x)]^2$
-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 $= V(x) = \Sigma\, E(x)^2 - \Sigma\, [E(x)]^2$

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

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

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

$\therefore$ Mean $E(x) = 9/8$ and variance $v(x) = 83/64$

c.

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

Solution :

x	P(x)	x. P(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	$\Sigma = 1$	$\Sigma = 6.05$	$\Sigma = 94.85$	$\Sigma = 27.7525$

$\therefore$ Mean $= E(x) = \Sigma x . P(x) = 6.05$

$\therefore$ variance $= v(x) = \Sigma E(x)^2 - \Sigma [E(x)]^2$

$= 94.85 - 27.7525$

$= 67.0975$

$\therefore$ Mean $E(x) = 6.05$ and Variance $v(x) = 67.0975$

Q2. If $P(x)$ is pmf of a random variable x. If $P(x)$ represents pmf for random variable x. find value of k. Then evaluate mean and variance.

Solution : As $P(x_i)$ is a pmf it should satisfy the properties of pmf which are

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

b). $\Sigma P(x_i) = 1$

PRACTICAL 1 :

Title : Random Variable

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	0.01
0	0.2	0	0.	0
1	0.3	0.3	0.3	0.09
2	0.4	0.8	1.6	0.64
Total	$\Sigma = 1$	$\Sigma = 1$	$\Sigma E(x)^2 = 2$	$\Sigma[E(x)]^2 = 0.74$

$\therefore$ 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 $E(x) = 1$ and variance $v(x) = 1.24$

8.8.

x	-1	0	1	2
$P(x)$	$1/8$	$1/8$	$1/4$	$1/2$

Solution :

x	$P(x)$	$x.P(x)$	$E(x)^2$	$[E(x)]^2$
-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 $= V(x) = \Sigma\, E(x)^2 - \Sigma\, [E(x)]^2$

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

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

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

$\therefore$ Mean $E(x) = 9/8$ and variance $V(x) = 83/64$

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

Solution :

x	P(x)	x. P(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	$\Sigma = 1$	$\Sigma = 6.05$	$\Sigma = 94.85$	$\Sigma = 27.7525$

$\therefore$ Mean $= E(x) = \Sigma x. P(x) = 6.05$

$\therefore$ variance $= v(x) = \Sigma E(x)^2 - \Sigma [E(x)]^2$

$= 94.85 - 27.7525$

$= 67.0975$

$\therefore$ Mean $E(x) = 6.05$ and Variance $v(x) = 67.0975$

If $P(x)$ is pmf of a random variable x. If $P(x)$ represents pmf for random variable x. find value of k. Then evaluate mean and variance.

Solution : As $P(xi)$ is a pmf it should satisfy the properties f Pmf which are

$P(xi) > 0$ for all sample space

$\Sigma P(xi) = 1$

Q.8.

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

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

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

$$13 = 3k - 2$$

$$15 = 3k$$

$$k = 5$$

x	$P(x)$	$x \cdot P(x)$	$E(x)^2$	$[E(x)]^2$
-1	$6/13$	$-6/13$	$6/13$	$36/169$
0	$5/13$	0	0	0
1	$1/13$	$1/13$	$1/13$	$1/169$
2	$1/13$	$2/13$	$4/13$	$4/169$
Total	$\Sigma = 1$	$\Sigma = -3/13$	$\Sigma = 11/13$	$\Sigma = 41/169$

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

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

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

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

$$= \frac{102}{169}$$

$\therefore$ Mean $= -3/13$ & variance $= 102/169$

Q. The p.m.f of random variable x is given by

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

Solution :

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
$F(x)$	0.1	0.3	0.45	0.65	0.75	0.90	0.95	1.0

① $P(-1 \leq x < 2) = P(x \leq 2) - P(x < -1) + P(x = -1)$
$= F(x_b) - F(x_a) + P(a)$
$= F(2) - F(-1) + P(-1)$
$= 0.75 - 0.3 + 0.2$
$= 0.25$

② $P(1 \leq x \leq 5) = F(x_b) - F(x_a) + P(a)$
$= F(5) - F(1) + P(1)$
$= 0.95 - 0.65 + 0.2$
$= 0.15$

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 $P(x \geq 0) = 1 - F(0) + P(0)$
$= 1 - 0.45 + 0.15$
$= 0.40$

Q8.

Let f be continuous random variable with Pdf

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

Obtain cdf of x

Solution: By definition of CDF we have

$$F(x) = \int_{-1}^{+1} t\,dt$$

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

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

Hence the cdf is

$$F(x) = 0 \quad \text{for } x < 1$$

$$= \frac{1}{4}x^2 + \frac{1}{2}x \text{ for } 1 \leq x < 1$$

$$= 0 \quad \text{for } x \geq 1$$

26. let f be continuous random variable with pdf

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

$= 0 \qquad$ otherwise

Calculate cdf

Solution: By definition of cdf we have

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

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

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

Hence cdf is

$F(x) = 0$ for $x < -2$

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

for $-2 < x < 4$

$= 0$ for $x \geq 4$

G.S.

Practical 2

Title: Binomial Distribution

An unbiased coin is tossed 4 times calculate ... of obtaining no head, atleast one head and ... One tail.

No HEAD:

```
> 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
```

The probability that student is accepted to a pre... College is 0.3. If 5 students supply, what's probability of atmost 2 are accepted.

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

Q.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
```

Q4. For n = 10, p = 0.6, evaluate binomial probabilities and plot the graphs of pmf and cdf.

```
> x = seq(0,10)
> y = dbinom(x,10,0.6)
> y
[1]  0.0001048      0.0015728640    0.0106168320
     0.0424673280   0.1114767360    0.2006581248
     0.2508226560   0.2149908480    0.1209323520
     0.0403107840   0.0060466176

> Plot (x, y, xlab = "Sequence", ylab = "probabilities", "D",
> x = seq(0,10)
> y = pbinom(x, 10, 0.6)
> plot (x,y, xlab="Sequene", ylab = "probabilities", "c
  pch =16)
```

5. Generate a random sample of size 10 for a B(8, 0.3). Find the mean and the variance of the sample.

```
> rbinom(8,10,0.3)
[1] 2 2 3 4 3 4 2 3
> mean(rbinom(8,10,0.3))
[1] 2.375
> var(rbinom(8,10,0.3))
[1] 1.696469.
```

26. The probability of men hitting the target is ... if he shoots 10 times what is the probability he hits the target exactly 3 times, probability ... he hits target atleast one time

```
> dbinom(3, 10,0.25)
[1] 0.2502823
> 1- dbinom(1,10,0.25)
[1] 0.8122883
```

27. Bits are sent for communication channel in packets of 12. If the probability of bit being corrupted ... what is the probability of no more than 2 bits corrupted in a packet?

```
> pbinom (2,12,0.1, lower.tail = F) + dbinom(2,12...
[1] 0.3409977.
```

Q1. A normal distribution of 100 students with mean marks 40 and s.deviation 15. Find the no. of students whose marks are ① Less than 30 ② 40 and 70 ③ 25 and 35 ④ more than 60.

mean = 40
s.d = 15
0.5 - pnorm (5.0, 40, 15)
0.2524725
pnorm (10,40,15) - Pnorm (40,40, 15)
0.4839377
pnorm (35, 40, 15) - Pnorm (25,40, 15)
0.2107861
more than 60
Pnorm (60, 40,18, lower.tail = F)
0.09121122

Q2. If the random variable 'x' follows to the normal distribution with mean 10, variance 100, s.deviation 10. Find ① P(x<70) ② P(x>65) ③ P(x<30) ④ P(35 < x < 60) ⑤ P(20 <x<32)

Pnorm (70, 50, 10)
0.1772499
Pnorm (65,50, 10, lower.tail = F)
0.0668072
Pnorm (30, 50, 10)
0.0224013
Pnorm (60, 50,10) - Pnorm (35, 50, 10) => 0.7745

Pnorm (31, 50, 10) - Pnorm (20, 50, 10)

0.05482120

let $x \sim (60, 400)$, find k_1 and k_2 such
$(x < k_1) = 0.1$ $\quad$ $P(x > k_2) = 0.8$

qnorm (0.1, 160, 20)

165.0669

qnorm (0.2, 160, 20)

143.1676

A random variable x follows normal distri[bution] with $\mu = 10$, $\sigma = 2$. generate 100 observa[tions] and find mean, median and variable.

rnorm (100, 10, 2)

mean = 9.911

median = 4.978

variable = 4.137851

Write a command to generate 10 random nos normally distribution with mean 50 std de[v] 4. Find sample mean and median.

rnorm (10, 60, 4)

mean = 51.45702

median = 51.79231

variance = 14.68388.

PRACTICAL 4

Sample mean and std. deviation given single population

Q1. Suppose the load level on the cookie bags states that it has almost 2 gms of saturated half in a single cookie. In a sample of 35 cookies, it was found that mean and saturated fat per cookie. 2.1 gm- Assume that the sample std. deviation is 0.3 at 15.% level of significance can be rejected the claim on food label.

$\sigma = 0.3$

$n = 35$

$\bar{x} = 2.1$

$\mu = 2$

H_0 (null hypothesis) = $\mu < 2$

H_1 (alt-hypothesis) = $\mu > 2$

$$z = \frac{2.1-2}{\frac{0.3}{\sqrt{35}}} = 1.972027$$

pvalue = 1- Pnorm(z)

= 0.0243

∴ Reject the null hypothesis ∵ pvalue < 0.05

∴ Accepted alternate hypothesis.

Q2. A sample of 100 customers was randomly selected and was found that average spinding was ... The SD = 30 using 0.05 level of significance ... you conclude that the amt. spent by the customers is more than 250/- whereas the restaurant ... that it is not > 250/-

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

$H_0 = \mu < 250$

$H_1 = \mu > 250$

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

$$= \frac{275 - 250}{30} = 8.33$$

>> pt(2, 99, lower.tail = F)

∴ pvalue = 2.305236e.13

⇒ Reject the null hypothesis ∵ pvalue < 0.05

∴ Accept the alternate hypothesis ($\mu > 250$)

3. A Quality control engineer finds that sample of 100 have average life of 470 hours. Assuming ... test whether the population mean is 480 hours population mean < 980 hours. at LoS → 0.05.

$n = 100$, $\bar{x} = 470$, $H_1 < 480$, $\sigma = 25$, $\mu = 480$

$$z = \frac{\bar{x} - \mu}{\sigma \sqrt{n}} = -4$$

pt(2, 99, lower.tail = 1)

$= 6.11257 \quad < 0.05$

→ Reject all null hypothesis $\therefore p < 0.05$

Accept the alternate hypothesis ($\mu_1 < 480$)

Q4. 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 claim of principal

Method 1 tail test

$H_0 = \mu = 100$

$H_1 = \mu - 100$

$\bar{x} = 112, \; SD = 15, \; \mu = 100, \; n = 30$

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

$$= \frac{112 - 100}{\frac{15}{\sqrt{30}}}$$

$$z = 4.38178$$

pvalue $= 5.885$?c $- \alpha$

Reject the null hypothesis = claims of principal [$\mu = 10$

Method 2 = 2 tail test

$H_0 = \mu = 100$

$H_1 = \mu \neq 100$

→ Pvalue = 2 × (1 − Pnorm (abs (z))) = 1.177134e

→ Reject the null hypothesis pvalue < 0.05

* Single population portion :

Q7 It is believed that coin is fair. The coin is tossed 40 times ; 25 times - Head occurs. Ind whether the coin is fair or not at 95

>> $z = \dfrac{p - p_0}{\sqrt{\dfrac{p_0 q_0}{n}}}$ → probability of population

$p_0 = 0.5$

$q_0 = 1 - p_0 = 0.5$

$p = \dfrac{25}{40} = 0.7$

$n = 40$.

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

$H_0 = \mu = 0.5$

$H_1 -- \mu \neq 0.5$

>> pvalue = 2 × (1 − pnorm (abs (z)))

∴ Pvalue = 0.0114 1204

→ Reject the null hypothesis ∵ P < 0.05

Accept the alternate hypothesis.

PRACTICAL- 5

Title : Chi Square Test.

Use following data to test whether the attribute conditions of home and child are independent.

		Condition of Homes.	
		Clean	dirth
Condition of child	Clean	70	50
	F.clean	80	20
	dirty.	35	45

H_0 = Both are independant, H_1 = Both are dependant

```
> 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
> chisq. test ( z)
```

Pearson's chi squared test

data : z

X - squared = 25. 646, df=2, p - value = 2.698 e

∴ Reject the null hypothesis

∴ Both are dependent.

Q2. A dice is tossed 120 times and following results are obtained.

No: of terms	Frequency
1	30
2	25
3	18
4	10
5	22
6	15

Test the hypothesis that dice is hypothesis

∴ H_0 = dice is tossed

∴ 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, df = length(obs) - 1)
[1] 0.956659
```

∴ Accept the null hypothesis.

∴ dice is unbiased.

Q3. An IQ test was conducted and the students were observed before and after training the result are 48 followed :

before	after
110	120
120	118
123	125
132	136
125	121

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

∴ H = no change in IQ

Ho = IQ increased after training

```
> a = c(120,118,125, 134,121)
> 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 training.

8

Q4.

	graduate	Undergrad
online	20	25
Face to face	40	5

Is there any association between students prefer
For type of education and method.

∴ H_0 : Independant
H_1 : Dependent

```
> x = c(20,40,25,5)
> z = matrix(x, nrow = 2)
> chisq.test(z)
```

Pearson's chi squared test with Yates continuity correction

data : z
X : squared = 18.05, df = 1, p-value = 2.157e-0

∴ Reject null hypothesis
∴ Both are dependant.

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 unbiased

H_0 : dice is biased
H_1 : dice is unbiased

```
> x = c(20,30,35,40,12,48)
> chisq.test(x)
  chi squared test for given probabilities

  data: x
  X-squared = 23.933, df = 5, p-value = 0.000223
```

∴ Reject null hypothesis
∴ Dice is unbiased.

Neat

Practical 6.

Q.1. let x = 3366, 3337, 3361, 3410, 3316, 3357, 3348, 3356, 3376, 3382, 3377, 3355, 3408, 3401, 3398, 3424, 3383, 3374, 3384, 3374.

Write R command for following to test hypo

1. $H_0 = \mu = 3400$, $H_1 : \mu \neq 3400$
2. $H_0 = \mu = 3400$, $H_1 = \mu > 3400$
3. $H_0 : \mu = 3400$, $H_1 : \mu < 3400$

at 95% level of confidence. Also check at 97, level of confidence.

→ ① $H_0 : \mu = 3400$

$H_1 : \mu \neq 3400$

```
> x = c(3366, 3337, 3361, 3410, 3316, 3357, 33
3356, 3376, 3382, 3377, 3355, 3408, 3401,
3398, 3424, 3383, 3374, 3384, 3374)
> t.test(x, mu = 3400, alter = "two.sided",
conf.level = 0.95).
```

one sample t.test.

data: x

t = -4.4865, df = 19, Pvalue = 0.0002

alternative hypothesis: true mean is not eq 3400

95 percent confidence level: 3961.717 336

Sample

mean of y = 3373.98

∴ Reject H0

∴ Accept H1

```
> t.test(x, mu = 3400, alter = "two.side")
        conf.level = 0.97)
```

one sample t.test

data : x

t = .44865, df = 19, p-value = 0.002528 alternative hypothesis : true mean is not equal to 3400

97 percent confidence level 3360.33

sample estimate

Mean of x = 3373.45

∴ Reject H0

∴ Accept H1

② t.test(x, Mu = 3400, alter = "greater", conf level = 0.95)

one sample t.test.

data : x

t = 4.4865, df = 19, p-value = 0.9999

sample estimate

Mean of X : 3373.95

Accept H0

C2

t. test (x, nu= 3400, alter = " greater", Sent, le 1
one sided t. test)

data : x

t = 4.4865, df = 19, p-value = 0.9999 alternate hypothesis, true mean is greater than 3400

3367.337 Inf

Sample estimates :

mean of x : 337398

Accept Ho

3

Ho = M = 3400

H1 = M ≤ 3400

> t. test(x, MV = 3400, alter " less " conf. level = 0.95)

one sided t. test

data x

t2 . 4.48.68 , 65, p-value = 0.0001256

alternate hypothesis : true mean is less than

95 percent confidence level

Int 3383.99

Sample estimate

mean of x :

Reject Ho

Reject H1

One sided t-test

data : x

t = 4.4865, df - 19 , pvalue = 0.0001264 alternative hypothesis : True mean is less than 97%. Confidence level.
InT 338.5563

Sample estimates
Mean of x 3373.95
∴ Reject Ho
∴ Accept H_1

Below use the data of given width of 2 different data A and B.

DATA (A) :- 25, 32, 30, 43, 24, 14, 32, 24, 31, 31, 35
DATA (B) :- 44, 34, 22, 10, 47, 51, 40, 30, 30, 32, 35, 18

H_0 :- a.b = 0
H_1 :- a-b ≠ 0

```
> a = c(25, 33 . . . . . . . . . . . 31, 35)
> b = c(44, 34, 24 . . . . . . . . 35, 18)
```

t.test (a, b paired = T. alter = " two sided". cat level = 0.98)

paired t.test.

alternate hypothesis : true difference in mean is not equal
to 0.

95% confidence level
-14.267330 7.933997
Sample estimate
-3.166660

∴ Accept H_0
∴ there is no differece in weight.

Q3. 2 student gave the test, after 1 month, they again gave the test after coaching do the marks give evidence that students are benefied by coaching.

E_1 : (23, 20, 19, 21, 28, 20, 18, 17, 23, 16, 19)
E_2 : (24, 19, 22, 20, 22, 20, 20, 20, 31, 20, 17)

E_1 = c(23, 20, 19, 21 .... 10, 19)
E_2 = c(24, 19, 22, ... 20, 17)

t. test (E_1, E_2, paired T. ~~alter~~ alter " ~~twe~~ conf ...

Paired t.test

data = f, and β

$t = 1.4832$, $df = 10$ p-value = 0.08441

alternatin hypothesis true difference is less than

99 % confidence level

Int 0.863333

Sample astimate

Man of the difference

-1

Accept No.

(4) Two days of BP was given and data was collected

D_1 = 0.3, -1.8, -0.2, -1.2, -0.1, -3.7, 0.2

B_2 :- 1.9, 0.8, 1.1, -0.1, 4.4, 5.5, 0.2

check which 2 drugs have the two days have same effect

$H_0 . D_1 = D_2$

$H_1 = D_1 \neq D_2$

D_1 = c (0.7, 1.8 . . . . 0.8, 0.3)

D_2 = c (0.8, 1.1 . . . . . 4.0)

. test

D_2

df = 9, pvalue = 0.00238

hesis :- the difference

nfidence level

f differe

1.58

: H_0

: H_1

difference in Salaries for the same job
fferent Companies

, 49958, 41997, 44310, 44360, 40740, 5694)
0, 58840, 4095, 52223, 47734, 43552)

(A-CB, Paired . T. alter = " test 1 sides "
conf. level = 0.95)

data = LA and RB

t = 4.4569, df = 5, pvalue = 0.00666.

Practical no: 7.

Q1. Life expentancy in 10 region of Indian is la... 2000 are given below. See whether the the value the 2 times are same.

1990 :- 37, 39, 46, 42, 45, 44, 46, 49, 50, 51

2000 :- 44, 45, 48, 43, 42, 49, 50, 41, 48, 52, 42, 58

$H_0 = n_1^2 = n_2^2$

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

S_1 = c(37, 39, 46 . . . . . . 50, 51)

S_2 = c(44, 45 . . . . . . 52, 42)

var. test(S_1, S_2)

p. value = 0.9176

P > 0.05

Accept H_0.

I :- (25, 28, 26, 22, 29, 31, 31, 26, 31)

II :- (30, 35, 21, 32, 23, 36, 26, 31, 32, 77.

$H_0 = \sigma^2 = S_2^2$

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

S_1 = c(25, 28, 26, 31, 37, 25, 31)

S_2 = c(30, 28, 31, 32, 25, 26, 31, 32, 31, 29)

$H_0 = \sigma^2 = \sigma_2^2$

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

s1 = c(25, 28, 26, 31 . . . . . . 31)

s2 = c(30, 25, 31 . . . . 29)

Pvalue = 0.5541

Accept Ho.

23. For the foll. data the hypothesis for equality of 2 population mean " " population variance.

$H_0 = \sigma_1^2 = \sigma_2^2$

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

H = c(175, 168, 145, 400, 181, 185, 925, 200)

4 = c(180, 170, 120, 183, 187, 205)

V.value = 0.7759

t.test(x, y)

P. value = 0.8216

Accept H.

24. The foll. are the price of countries in the sample of ~~shop~~ selected from recommended from recommended cities.

City AB = (74, 10, 77 . . . . 76, 100)

City B = (70, 80, 74 . . . . . . 81, 80)

x = c(74, 10, 77 . . . . 76, 100)

y = c(70, 80, 74, 90, 72 - 80, 44 70, 81-20)

sharpiron length(x)

Pvalue = 0.1559

pvalue = 0.9304

$H_0 = \sigma_1^2 = \sigma_2^2$

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

r value = 0.04249.

2 variance are not equal object Ho Accept R_1

Ho $\overline{x_1} = \overline{x_2}$

$\overline{x_1} \neq \overline{x_2}$

t. text x, var.equal=F)

t. test (y, var.equal = f).

Accept Ho.

Qs. Prepare a csv file in excel Import the file in and Apply the test clrscr the equality of variance OR 2 data.

obs : 01 : - (10,15,17,11 . . . . . . .20)

obs : 02 : (15,14,16 . . . . 19)

Data.

Obs : 01	Obs : 02
10	15
15	14
17	16
11	11
16	12
20	19

```
> attach(data)
> mean(Obs)
   14.83333

> var test(ob31, ohs2)
```

p-value = 0.571

Accept H0.

Neelu

Practical 8.

Non Parametric Test

1. The times of failures in hrs of 10 random selected 9 volt battery of a certain company is as follows

28.9, 15.2, 28.7, 72.5, 48.6, 52.4, 37.6, 49.5, 62.1, ...

Test the hypothesis that the population median is 63

∴ H_0 : median = 63

∴ H_1 : median < 63

```
x = c(28.9, 15.2, 28.7, 72.5, 48.6, 52.4, 37.6, 49.5,
      62.1, 54.5)
> sp = length(which(x>63))
> sn = length(which(x<63))
> sp
4
> sn
1
> n = sp+sn
> qbinom(0.05, n, 0.5)
2
```

∴ qbinom < sn

∴ Accept H_0

∴ Median = 63.

22. The following data gives the weight of 40 students in random sample 46, 49, 57, 64, 46, 67, 54, 48, 69
61, 57, 54, 50, 48, 65, 61, 66, 54, 50
48, 49, 62, 47, 49, 47, 55, 59, 63, 53
56, 67, 49, 60, 64, 53, 50, 48, 51, 52, 54)

```
> sp = length(which(x>50))
> sp
  25
> sn = length(which(x<50))
> sn
  12
> n = sp+sn
> qbinom(0.05, n, 0.5)
  14
```

∵ qbinom > sn

∴ Reject Ho.

38

Q3: The median age of tourist visiting a certain place is claim to had 41 hrs. A random sample of 40 tourists have the age.

25, 29, 52, 48, 57, 39, 45, 36, 30, 49, 45, 36, 63, 55, 42)

~~>Sp=~~

∴ Ho = median = 41

H1 = median ≠ 41

```
> x = c( 25, 29, 52, 48, 57, 39, 45, 36, 63, 32, 55, 42)
> sp = length( which (x>5 ))
> sp
4
> sn = length (which (x<4))
> sn
8
> n = sp+sn
> 2 binom (0.05, n, 0.5)
5
```

2binom Sn

Accept Ho

median = 41

the times in numeric that has to wait quit solins is given. Check whether the weight increases 400 stop using welcox. That pts % of sign peat.

Solution Ho = median = after you the studing.

H1 = weight dont change

```
a = c( 65, 75, 75, 62, 72 )
b = c( 72, 82, 72 62, 73)

> a.b-a
> x.
7, -7, 3, -4, -1
> wilcox . text (X, Mv=0)
p.value = 0.1756
```

pair, pvalue > 0.05

Accept Ho.

Neat

Practical 8.

1. The times of failure in his, t 10 randomly selected 9 volt battery of a certain company is as follows
(28.9, 18.4, 28.4, 72.5, 48.6, 52.4, 37.6, 49.5, 621, 54.5).

Test the hypothesis that the population on Median is 63 against alternative is then 63 at 5% of level of significance.

∴ Ho = Median = 6.3

H = Median = 63

n = c (28.9, 18.2, 28.7, 72.5, 48.6, 52.4, 37.6, 49.7, 62, 1, 54.5)

> S.P = length (which (x > 63))

> SA = length (which (x < 63))

> SP

> 2

> Sn

1

> x = SP + Sn

> q binom(0.08, n, 0.5)

∴ abinom < Sn

Accept Ho

Median = 63

2. The following data gives the weight of 40 students in random sample.

46, 44, 57, 64, 46, 54, 48, 69, 61, 57, 54, 50, 48, 65, 61, 66, 84, 50, 48, 44, 62, 47, 44, 47, 33, 34, 63, 53, 56, 67, 44, 60, 64, 33, 30, 48, 31, 32, 34

Use the sign test to test whether the median rate of population is 50 kg against alternative it is 150kg.

∴ Ho = median - 50

H1 = median - 750

x = c (46, 44, 57, 64, 46, 67, 54, 69, 43, 61, 57, 54, 50, 48, 65, 61, 66, 54, 50, 43, 49, 62, 47, 49, 47, 55, 59, 63, 53, 56, 67, 49, 60, 64, 53, 50, 48, 51, 52, 54

> sp = length which (x > 50)

> SP

is

> Sn = length (which (x < 50)

Sn

12

> n = sp + Sn

> q binom (0.05, n, 0.5)

∴ a binom > Sn

∴ Reject Ho.

3) The median age of tourist visiting a certain place is claim to set 41 yrs A random sample of 20 tourists have the age.

25, 24, 52, 48, 57, 34, 45, 36, 30, 49, 28, 39, 44, 63, 32, 65, 29, 42. Use the sign test to check the claim

H_0 : median $= H_1$

H_1 : median $= H_1$.

```
> x = c(25,29,52,48,57,39,45,36,30,44,26,3
        44,63,32,65,42)
> sp = length(which(x>h))
> sp
9
> sn = length(which(x>41))
> sn
8
> n = sp + sn
> qbinom(0.05,n,0.5)
5
```

qbinom < Sn

$\therefore$ Accept H_0

$\therefore$ Median $= H_1$

The time in minimum that a patient has to wait to consultation in recommended as following is 24, 25, 20, 21, 32, 28, 12, 25, 24, 26.

We will use sign test to check whether median waiting test more than 20 at

68 Practical 9

8. The following data gives the effects of 3 treatments

T_1 : 2, 3, 7, 2, 6

T_2 : 10, 8, 7, 5, 10

T_3 : 10, 13, 14, 13, 15.

Test the hypothesis that all treatements are equally effective.

$H_0 = T_1 = T_2 = T_3$

$H_1 = T_1 \neq T_2 \neq T_3$

```
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)
d

x = as.matrix (d)
e = stack (d)
aov ( value ~ind, data = e).
oneway.test (values ~ind, data = e).
```

p-value = 0.0006232

∴ Reject H_0.

60

The life cycle of different brand of tyres is given Test whether the driving test of all tyre is the same.

H_0 = life of all brands of tyres is same

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

```
a = c( 20, 23, 18, 13, 22, 24)
b = c( 10, 15, 11, 20, 15, 17)
c = c( 21, 29, 22, 17, 20)
d = c (15, 14, 16, 18, 14, 16)
m = list( a, b, c, d)
m
e = stack (m)
m = list (p = a, q = b, r = c, s = d)
m
e = stack (m)
e
oneway.test ( value ~ind, data = e, var- equal = TRUE)
```

p.value = 0.004058

∴ Reject H_0.

Q3. 23. Three types of wax is applied for the protection of cars and no. of days of protection were noted. Test whether these protections are equally effective.

Ho :- Equally effective.
H1 :- Not equally effective.

a = c (44, 45, 46, 47, 48, 49)
b = c (40, 42, 51, 52, 55)
c = c(50, 53, 58, 59)
m = list (a = a, g = b, r = c)

m

e = stack(m)

e

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

p.value :- 0.03822

∴ Reject Ho.

24

An experiment was conducted on 8 persons the observation were noted. Test the hypothesis that all groups have equal results on their health

Ho - equal result on their health.
H1 Not equal result.
a = c (23, 26, 51, 48, 58, 34, 29, 44)
b = c(22, 27, 29, 39, 46, 48, 49, 65)
c = c(84, 66, 38, 49, 56, 60, 56, 62)

d = data .frame (a, b, c)
x = as. matrix x(d)
e = stack(d)

aov (values ~ ind, data = e)
oneway. test(values ~ ind data = e)
p.value = 0.01633.
∴ Reject Ho.