Practical No: 1

Topic : Random Variable

Q. Find the mean and variable for the following:

a)

x	-1	0	1	2
$P(x)$	0.1	0.2	0.3	0.4

x	$P(x)$	$x \cdot P(x)$	$E(x)^2$	$[E(x)]^2$
-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	1.6	0.64
Total	$\Sigma = 1$	$\Sigma = 1$	$\Sigma E(x)^2 = 2$	$\Sigma [E(x)]^2 = 0.74$

$\therefore$ Mean $= E(x) = \Sigma x_i \cdot P(x) = 1$

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

$= 2 - 0.74$

$= 1.24$

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

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

Soln. 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	Σ=1	Σ = 9/8	Σ 19/8	Σ = 69/64

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

$\therefore$ 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)	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	Σ=1	Σ=6.05	Σ=94.8	Σ = 27.7525

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

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

$= 94 - 85 - 27.7525$

$= 67.0925$

Mean $E(x) = 6.05$ & variance $V(x) = 67.0945$

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 evalute mean & variance

→ As P(xi) is a pmf it should satisfy the properties of my which are.

a] P(xi) > 0 for all sample space

b] Σ P(xi) = 1

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

$\Sigma P(xi) = 1 = \frac{K+1}{13} + \frac{15}{13} + \frac{1}{13} + \frac{K-4}{13}$

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

$13 = 3K - 2$

$15 = 3K$

$K = 5$

x	P(x)	x·P(x)	Σ(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	Σ=1	Σ=−3/13	Σ=11/13	Σ=41/169

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

$\therefore$ 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.3. 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 i) $P(-1 \le x \le 2)$ ii) $P(1 \le x \le 5)$ iii) $P(x \le 2)$ (iv) $P(x \geq 0)$

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 $P(-1 \le x \le 2) = P(x \le 2) - P(x \le -1) + P(x=-1)$

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

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

$= 0.75 - 0.3 + 0.2$

$= 0.25$

② $P(1 \le x \le 5) = F(x_b) - F(x_a) + P(a)$

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

$= 0.95 - 0.65 + 0.2$

$= 0.15$

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

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

$= 0.75$

④ $P(x \geq 0) = 1 - F(0) + P(0)$

$= 1 - 0.45 + 0.15$

$= 0.40$

Q4. Let f be continuous random variable with pdf

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

$= 0$, otherwise

Obtain, cdf of x

Soln. By definition of c.d.f we have

$F(x) = \int_{0-1}^{1} t\, dt$

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

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

Hence the cdf is

$F(x) = 0$ for $x \le -1$

$= \frac{1}{4}x^2 + \frac{1}{2}x$ for $-1 \le x \le 1$

$= 0$ for $x \geq 1$

Q5 Let f be continuous random variable with p.d.f

$\therefore f(x) = \frac{x+2}{18}$ $-2 < x < 4$

$= 0$ otherwise

Calculate c.d.f

Soln By definition of cdf we have

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

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

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

for $-2 < x < 4$

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 $x \geq 4$

Practical No: 2

Topic: Binomial Distribution

Q1 An unbiased coin is tossed 4 times. calculate the probability of obtaining no head, atleast one head and more than one tail.

- No head:

> d.binom(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 supply, what's the 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 $P(x=2)$, $P(x=2)$, $P(1 < x < 5)$

> dbinom (2, 6, 0.3)

[1] 0.324135

> dbinom (3, 6, 0.3)

180)
[1] 0.18522

> dbinom (2,6,0.3) + dbinom (3,6,0.3) + dbinom (4,6,0.3)

[1] 0.74373

Q.4 for n=10, p=0.6, evaluate binomial probabilities and plot the graphs of p.m.f and c.d.f

> x = seq (0,10)

> y = dbinom (x,10,0.6)

> y

[1] 0.0001048576 0.0015728640 0.0106168320

0.0042467328 0.0111476736 0.2006581248

0.0424673280 0.2149908480 0.1209323520

0.2508226560

0.0403107840 0.0060466176

> plot (x,y, xlab="sequence", ylab="probabilites", "o", pch =16)

> x = seq (0,10)

> y = pbinom (x,10,0.6)

> plot (x,y, xlab="sequence", ylab=" probabilities ","o", pch =16)

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

> x = rbinom (8,10,0.3)

[1] 2 2 3 4 3 4 2 3

> rbinom (8,10) summary (x)

[1] 2.375

> var(x)

[1] 5125

031

Q.6 The probability of man hitting the target is 1/4 if he shoots 10 times what is the probability that he hits the target exactly 3 times, probability that he hits target atleast one time.

> dbinom (3,10,0.25)

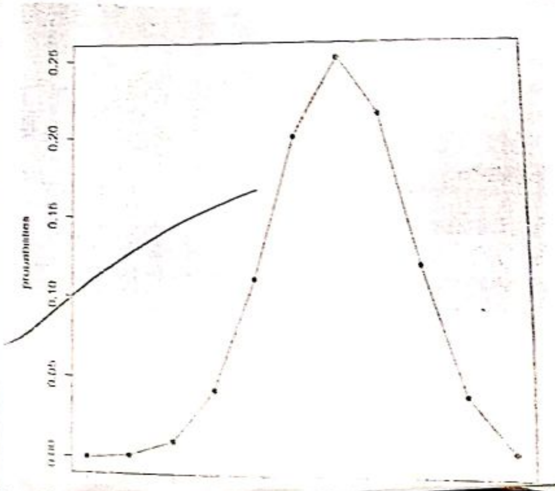
[1] 0.2502823

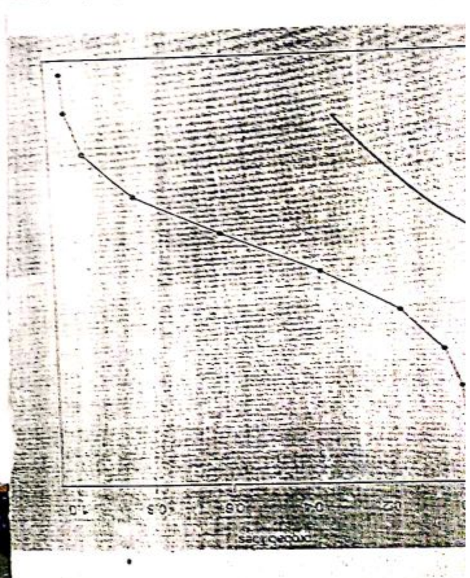
> 1- dbinom (1,10,0.25)

[1] 0.122883

Q.7 Bits are sent for communication channel in packet of 12. If the probability of bit being corrupted is 0.1 what is the probability of no more than 2 bits are corrupted in a packet?

> Pbinom (2,12,0.1, lower.tail = F) + dbinom (2,12,0.1)





180 Practical : 03

Q.1) A normal distribution of 100 students with mean marks 40 & s.deviation - 15. find the no. of students whose marks are ① less than 30 ② 40 & 70 ③ 25 & 35 ④ more than 60

→ Mean = 40
S.d = 15
0.5 − Pnorm (50, 40, 15)
0.2524727

1) Pnorm (10, 40, 15) − Pnorm (40, 40, 15)
0.4839377

2) Pnorm (35, 40, 15) − Pnorm (25, 40, 15)
0.2107861

more than 60

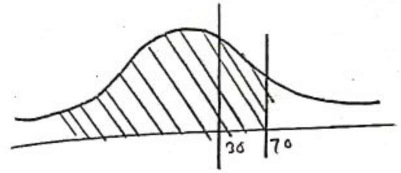
3) Pnorm (60, 40, 15, lower.tail = F)
0.09121122

Q2) If the random variable (x) follows the normal distribution with mean 0. Variance 100, s.d. deviation 10 find ① P(x ≤ 70) ② P(x > 65) ③ i(x ≤ 30) ④ P(35 < x < 60) ⑤ P(20 < x < 32)

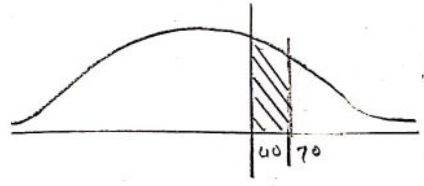
→ Pnorm (70, 50, 10)
0.1772499
Pnorm (65, 50, 10, lower.tail = F)
0.0668072
Pnorm (30, 50, 10)
0.0224013

Q.1.

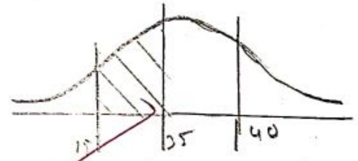
a)



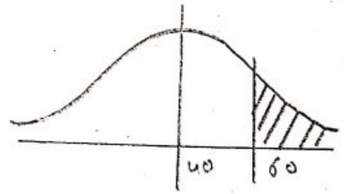
b)



c)

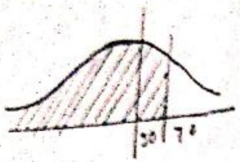


d)

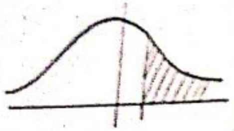


Q. Q.7.

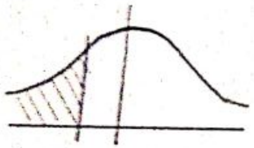
a)



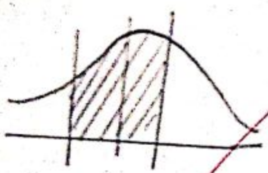
b)



c)



Q d)



e)

Pnorm (60, 50, 10) - Pnorm (35, 50, 10) - 0.7745

Pnorm (37, 50, 10). Pnorm (20, 50, 10) - 0.05482180

3) let x x (60, 400), find let k1 k2 such that
(x < k1) = 0.6 P(x > k2) = 0.8

- qnorm (0.6, 160, 20)
165.0669
qnorm (0.7, 160, 20)
143.1676

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

→ xnorm (100, 10, 2)
mean = 9.911
median = 4.928
variable = 4.137857

5) write ~~a~~ command to generate 10 random nos for normally distribution with mean 50 std deviation 4 find the sample mean & median

→ norm - (10, 50, 4)
mean = 51.45792
median = 51.7923
Variable = 14.68355

Q2. A Sample of 100 customers was randomly elected & found that average spending was 275/. The SD = 30 using 0.05 level of significance, would you conclude that the amt. spent by the customers more than 250/- whereas the restaurant claims that it is not >250/-

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

$H_0 = \mu < 250$

$H_1 = \mu > 250$

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

$$= \frac{275 - 200}{\frac{30}{\sqrt{100}}} = 8.333$$

>?? Pf(z, 99, lower.tail = f)

$\therefore$ Pvalue = 2.305736e.13

$\rightarrow$ Reject the null hypothesis $\because$ pvalue < 0.05

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

Q3. A quality Control engineer find that sample of 100 have average life of 470 hours assuming population test whether the population mean is 480 hours vs population means < 480 hrs at LoS $\rightarrow$ 0.05

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

$$?? \quad Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = -4$$

>?? pf(z, 99, lower.tail = T)

= 6.112576e-05

$p < 0.05$

→ Reject the null hypothesis ∵ ~~P<0.05~~ Ca, ...
∴ Accept the alternate hypothesis

Qu. A principal at school claims that the IQ is 100 & of the student. A random sample of 30 students ... IQ was found to be 112 the SD of population = 15. Test the claim of principal.

→ Method 1 : 1 tail test

→ $H_0 = \mu < 100$

$H_1 = \mu > 100$

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

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

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

$= 4.38178$

P value = 5.888567e.06

→ Reject the null hypothesis = claims of principal [...

Method 2: 2 tail test

$H_0 = \mu = 100$

$H_1 = \mu\ 100$

→ P value = 2 × (1 − Pnorm (abs (z))) = 1.77134e.05

→ Reject the null hypothesis ∵ pvalue < 0.05

Pvalue = 2x(1-pnorm(abs(z)))
∴ Pvalue = 0.2060506.
∴ Pvalue of the null hypothesis < 0.5
∴ Reject the null hypothesis
∴ Accept the alternative hypothesis
i.e $p \neq 100$.

Q.2. In a big city, 325 men out of 600 men are found to be self employed. Conclusion is that maximum men in city are self employed.

$$z = \frac{p - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$$ $p \to 325/600 = 0.541607$, $p_0 = 0.5$, $q_0 = 0.5$, $n = 600$

$H_0 = [p_0 = p]$
$H_1 = [p \neq p_0]$

>>> p_2 = (0.5416 − 0.5)/(sqrt(0.5 * 0.5 × 600))
>>> z = 2.037975
>>> pvalue = 2x(1-pnorm(abs(z)))
>>> p value = 0.04155239

Q.3 Experience shows that 20% of manufactured products are of top quality. In 1 day production of 400 articles only 50 are of top quality. Test hypothesis that experience of 20% of products in wrong?

$$z = \frac{p - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$$, $p = 0.125$ (50/400), $p_0 = 0.2$, $q_0 = 0.8$, $n = 400$

$H_0 = [p_0 = 0.2]$
$H_1 = [p_0 \neq 0.2]$

>>> z = (0.125-0.2)/(sqrt(0.2*0.8/400))
>>> z = −3.75
>>> Pvalue = 2x(1-pnorm(abs(z)))
Pvalue = 0.0001768346

* formula.

$$z = \sqrt{pq\left(\frac{1}{n} + \frac{1}{m}\right)}$$ where $p = \frac{p_1 n + p_2 m}{n+m}$

Q.1. In an election campaign a telephone, of 800 registered voters shows favour 460 secured pole opinion 520 of 100 registered voters favoured the condition of 0.5 %. L.o.C (level of confidence) is there sufficient evidence that popularity has decreased.

$n = 800$, $p_1 = 460/800 = 0.575$, $m = 1000$, $p_2 = 520/1000 = 0.52$
p = (0.575 * 800 + 0.52 × 1000) / (1800)
p = 0.54444

z = sqrt (0.54 * 0.46) + 1/8
z = 0.001121394.

H_0 = p = 0.544
H_1 = p < 0.544

Pvalue = (2 × (1 − pnorm (abs(z))))
∴ p value = 0.9991053

Accept the null hypothesis ∵ pvalue > 0.5
Accept p_2 0.5444.
z = sqrt (0.54 * 0.46) + 1/8
z = 0.001121394.

$H_0 = P = 0.544$
$H_1 = P < 0.544$

Pvalue := (2 x (1 - pnorm (abs (z))))
∴ pvalue := 0.9991053

Accept the null hypothesis ∵ pvalue > 0.5
Accept P = 0.5444

Q2) From a consignment A, 100 articles are drawn & 44 were found defectives from consignment B, 200 samples are drawn out of which 30 are defective. Test whether the proportion of defective items in 2 consignments are significantly different.

$H_0 = P_1 = P_2$
$H_1 = P_1 \neq P_2$
$P_1 = 44/200 = 0.22$
$n = 200 = m$
$P_2 = 30/200 = 0.15$

> P = (P1n + P2m) / (n+m)

> P = (0.22 * 200 + 0.15 * 200) / 400

> p = 0.185

> z = (sqrt (0.185 * 0.815 * (2/200))

> z = 0.03882976

Practical 5

Title : Chi square Test

Q1) Use the following data to test whether the attribute Conditions of ~~bo~~home & child are independent

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

H_0 = Both are independent, H_1 = 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

> chisq.test(z)

Pearson's Chi squared test data : z

x - squared = 25.646, df = 2, p-value =

∴ Reject the null hypothesis

∵ Both are dependent

Q2) A dice is tossed 120 times & following results are obtained

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

Test whether there is change in the IQ after the training

∴ Ho = no change in IQ
∴ Ho = IQ increased & after training
> 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 training

Q4)

	Graduate	Undergraduate
Online	20	25
face to face	40	5

Is there any association between, students preference for type of education & method.
∴ Ho : Independent
H1 : 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 = 2157e-05

∴ Reject null Hypothesis

∴ Both are dependent

Q.5] 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°: dice is baised

H: dice is unbaised

> x = c(20, 30, 35, 40, 12, 43)

> chisq.test(x)

Chi squared test for given probabilities

data : z

X- squared = 23.933, df = 5, P- value = 0.0002

∴ Reject null hypothesis

∴ dice is unbiased

Practical : 6

Title : t test

Q1. Let x = 3366, 3337, 3361, 3410, 3316, 3357, 3348, 3356, 3376, 3382, 3377, 3353, 3408, 3401, 3398, 3424, 3383, 3374, 3384, 3376, 3384, 3374

Write the R command for following to hypothesis

(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 9.5% level of Cofidence , 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, 3348, 3356, 3376, 3382, 3377, 3355, 3401, 3398, 3424, 3383, 3374, 3384, 3370)

> t.test (x, mu = 3400, alter = "two. sided", conf. level=0.95)

One sample t.test

data : x

t = -4.4865 , df = 19, Pvalue = 0.0002528 alternative hypothesis . true mean is not equal to 3400

95 percent confidence level :

3361.797 3386.103

083

Sample estimates
Mean of x:
3373.95

∴ Reject H_0; Accept H_1

> t.test (x, mu = 3400, alter = "two sides", confidence = 0.9

One sample test

data: x
t = -4.4865, df = 19, P-value = 0.0002528 alternative
hypothesis: true mean is not equal to 3400, 3360
338757

Sample estimates
Mean of x:
3373 95

∴ Reject H_0, Accept H_1

(2) $H_0 = \mu = 3400$
$H_1 = \mu > 3400$

> t.test (x, mu = 3400, alter = "greater", conf.level =

one sample test

data: x
t = -4.4865, df = 19, P.value = 0.9994 alternative
hypothesis: true mean is greater than 3400
3363.91

Sample estimates
Mean of x:
3373.95

∴ Accept H_0, Reject H_1

7t.test.(x, Mu= 3400, alter = "greater", conf.level = 0.99)

one sided t.test

data : x

t = -4.4865, df = 19, P.value = 0.9999 alternative

hypothesis : true mean is greater than 3400

3367.37 Inf

Sample estimate:

Mean of x :

337 395

∴ Accept H_0

(3) $H_0 = \mu = 3400$

$H_1 = \mu < 3400$

7t.test (x, Mu= 3400, alter= "less", conf.level = 0.95)

one sided t-test

data = x

t = -4.4865, df = 19, P value = 0.0001284

alternative hypothesis : true mean is less than 3400

95 percent level of confidence

- Inf 3383.99

Sample estimates

Mean of x 3373.95

∴ Reject H_0. Accept H_1

7t.test (x, Mu= 3400, alter = "less", conf.level = 0.94)

On sample test

data = x

t = -4.4868, df = 19, P value = 0.0001204
alternative hypothesis : true mean is less than 3400
97 percent level of confidence :
-Inf -3385.563

Sample estimate:
Mean of x
3373.95

∴ Reject Ho, Accept H1.

Q.7. Below are the data of gain in weights on 2 different diets A & B

Diet A :- 25, 32, 30, 43, 24, 14, 32, 24, 31, 31, 35, 25.

Diet B :- 44, 34, 22, 10, 47, 31, 40, 30, 32, 35, 18, 21

∴ H_0 : a - b = 0

H_1 : a - b ≠ 0

> a = c (25, 32, 30, 43, 24, 14, 32, 24, 31, 31, 18, 21)

> a = c (44, 34, 22, 10, 47, 31, 40, 30, 32, 35, 18, 21)

t.test (a, b, Paired = T, alter = "two sided", conf.level = 0.95)

Paired t-test

data : a and b

t = -0.62787, df = 11, P. value = 0.5912
alternative hypothesis : True difference in Means is not equal to 0 + 95 percent confidence interval
: 16.267730 7.933997 .
Sample estimates.
Mean of the differences = 2.166667

∴ Accept H0, Reject H1.
∴ There is no difference in weight

iv) Students gave the test after 1 month they again gave the test after the tuitions do the marks gives evidence that students have benifitte by coaching

C1: 23, 20, 19, 21, 18, 20, 18, 17, 23, 16, 19
C2: 24, 19, 22, 16, 20, 22, 20, 20; 23, 20, 17
test at 99 level of Confidence.

C1 : 23, 20, 19, 21, 16, 20, 18, 17, 23, 16, 19
C2 : 24, 19, 22, 18, 20, 22, 20, 20, 23, 20, 17
∴ H0 = C1 = C2
∴ H1 = C1 < C2
> t. test (c1, c2, paired = T, alter = "less".
Conf. level = 0.99)

Paired t. test
data = c1 and c2.

t = -1.4832, df = 10, p-value = 0.0844
alternative hypothesis: true difference in means is less than 0
99 percent confidence interval
= -Inf 0.8633333

Sample estimates
Mean of the differences

∴ Accept H_0, Reject H_1

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

The two drugs have same effect, check whether two drugs have same effect on patient or not

7b = c(44, 34, 27, 10, 47, 31, 40, 30, 32, 35, 18, 21)

t-test (a, b, Paired = True, alter = "two sided", conf.level 0.

paired t-test

data : a and b
t = -0.62787, df = 11, p-values = 0.5429
alternative hypothesis = true difference in means is not equal to 0
95 percent confidence interval
-/n 26.7330   7.933997
Sample estimates.

Mean of the differences
- 3.16666.7

∴ ~~Re~~ Accept H_0, Reject H_1

∴ There is no difference in weightness

Q7 11 students gave the test after 1 month they of gave the test after the tuitions do the marks gives evidence that student have benifits by coaching

t1 : 23, 20, 19, 21, 18, 20, 18, 17, 23, 16, 19,
t2 : 24, 19, 22, 18, 20, 22, 20, 20, 23, 20, 17

test at 99 level of confidence

→ H_0 : $d_1 = d_2$
$H_1 = d_1 \neq d_2$
>d1 = c(0.7, -1.6, -0.2, -1.2, -0.1, 3.4, 3.7, 0.8, 2.0,
>d2 : c(1.0, 0.6, 1.1, 0.1, -0.1, 4.4, 5.5, 1.6, 4.6, 3.4)
>t.test (d1, d2, alter = "two sided", conf.level = paired = t.test
data : d1 and d2
t: -4.0621 , df = 9, P-value = 0.002833,
alternative hypothesis : true difference in Means is not equal to 0
95 percent Confidence interval.
Mean of the differences. -1.58

∴ Reject H_0
Accept H_1

740

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

CA = 53000, 49956, 41974, 44366, 40470, 38963

CB = 62490, 58850, 49495, 52263, 47674, 43552

⇒ $H_0 = S_1 = S_2$

$\therefore H_1 = S_1 \neq S_2$

> CA = c(53000, 499958, 41974, 844866, 40470, 38963)

> CB = c(62490, 58850, 49495, 52263, 47674, 43552)

> t.test (ca, cb, paired = T, alter = "two sided" conf.level...

Paired T. test

data : ca and cb

t = -4.4569, df = 5, P value = 0.00666

alternative hypothesis : true difference at means is not equal to 0.

95 percent Confidence interval :

-10404.821 -2792.846

Sample estimates

Mean of the differences -6698.833

∴ Reject H_0

Accept H_1

Practical No: 7

Title : F Test.

Q1. Life expectancy in 10 region of India in 1990 and 2000 are given below test whether the variance at the 2 time are same.

1990 37, 39, 36, 43, 45, 44, 46, 49, 50, 51

2000 44, 45, 47, 43, 42, 49, 50, 41, 48, 52, 42, 59

→ >x=c (37, 39, 36, 43, 45, 44, 46, 49, 50, 51)

>y=c (44, 45, 47, 43, 42, 49, 50, 41, 48, 52, 42, 59)

var. test (x,y)

F test to compare two variances data : x and y

F= 1.0548 ; num df = 9; denom df = 11; p-value = 0.9176

alternative hypothesis : true ratio of variance is not equal to

95 percent confidence interval :

0.2939477 . 4.1265887

Sample estimates

ratio of variance

1.054834

∴ Accept H_0

∴ Variance at 2 times are same.

Q2. I 25 28 26 22 29 31 31 26 31

II 30 25 31 32 23 25 36 26 31 32 32 27 31 38, 21

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

047

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

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

>x = c (25, 28, 26, 22, 29, 31, 37, 26, 31)

>y = c (30, 28, 31, 32, 23, 25, 36, 25, 31, 32, 32, 27, 31, 38, 24)

>var.test (x, y)

F test to compare two variance

P-value = 0.4535

∴ Accept the H_0.

∴ Variance of I and II are same

Q.2.

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, 190, 161, 185, 175, 200

Sample 2: 180, 170, 153, 180, 179, 183, 187, 205

→ (1) $H_0 = \mu_1 = \mu_2$

$H_1 = \mu_1 \neq \mu_2$

>x = c (175, 163, 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)

Welch two sample t-test

P-value = 0.9771

∴ Accept H_0

∴ equality of 2 population mean are same.

② equality of proportion variance:
> val. test (x, y)
F. test to compare two variances
p-value = ~~0.745~~ 0.7751
∴ Accept H_0
∴ equality of proportion variance are same.

Q. The following are the price of commodity in their sample of shops selected at random from different ~~density~~ city.

City A: 74.10, 77.70, 75.35, 74, 73.80, 79.30, 75.80, 76.80
77.10, 76.40

City B: 70.80, 74.90, 76.20, 72.80, 78.10, 74.70, 69.80,
81.20.

∴ $H_0: \sigma_1^2 = \sigma_2^2$
$H_1: \sigma_1^2 \neq \sigma_2^2$

> x = c(74.80, 77.10, 75.36, 74, 73.80, 79.30, 75.80, 79.30.
6.80, 77.10, 76.40)

> y = c(70.80, 74.90, 76.20, 72.80, 78.10, 74.70, 69.34, 81.20)

> Val. test (x, y)
f.test to compare two variance
p-value = 0.02751.
∴ Reject H_0
∴ equality of 2 population mean are not same

> t.test (x, y, var.equal = F, paired = F)
which Two sample t-test

p-value = 0.3244

∴ Accept H_0

∴ Mean of two population is same

Prepare a CSV file in excel import the file in R and apply the test to check the equality of Variance of 2 data

Observed 1 : 10 18 17 11 16 20

Observed 2 : 15 14 16 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 in CSV (MS-DOS) format

> data = read.csv (file.choose (), header = T)

> data

X	OB.1	OB.2
1	10	15
2	15	14
3	17	16
4	11	11
5	16	12
6	20	14

> attach (data)

> var.test (OB.1, OB.2)

F test to Compare two variance
P- value = 0.5717

∴ Accept H_0
∴ The variance of 2 data are same.

Lah

Practical 8

Title : Non parametric test

1) The times of failure in hrs of 10 randomly 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, 54.5

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

∴ H_0 : median = 63

∴ H_1 : Median < 63

x = c (28.9, 18.2, 28.7, 72.5, 48.6, 52.4, 37.6, 49.7,
62.1, 54.5)

> sp = length (which (x > 63))

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

> sp

> n

> sn

1

> n = sp + sn

> q binom (0.05, n, 0.5)

2

∴ qbinom < sn

Accept H_0

Median = 63

Q2. The following data gives the weights of 40 student in random sample
46, 49, 57, 64, 66, 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,
Use the sign test to test whether the median rate of population is 50kg against alternative it is > 50 kg

∴ Ho = median = 50
H_1 = median > 50
x = c(46, 49, 57, 64, 66, 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
∴ a binom > & n
∴ Reject Ho

8:50

3) The median age of tourists visiting a certain place is claim to be 41 yrs A random sample of 70 tourists have the age
25, 29, 52, 48, 57, 39, 45, 36, 30, 49, 28, 39, 44, 63, 32, 65, 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, 49, 28, 39, 44, 63,
32, 65, 42)

> sp = length (which (x > 41))

> sp

9

> sn = length (which (x > 41))

> Sn

8

> n = sp + sn

> qbinom (0.05, n, 0.5)

5

∵ qbinom < Sn

∴ Accept H_0

∴ Median = H_1

Q4 The times in minimum that a patient has to wait to consultation in recorded as following 15, 17, 24, 25, 20, 21, 32, 28, 12, 25, 24, 26
We will cox sign test to check wheather median waiting test more than 20 at 5%. is =

→ H_0 = Median > 20
→ H_1 = Median < 20
x = c(values ....)
wilcox.test(x, alternative, = "less")
pvalue = 0.999
Accept = H_0

Q5 the net in kgs of the person before after they stop smoking are as follows 65, 70, 70, 65, 72.
After 72, 82, 72, 66, 73. Use wilcox test to check whether this the net of person there as after smoking use

→ H_0 = increases after this stopping of smoking
→ H_1 = does not increases after of smoking
x → (values ....)
→ z = x - y
→ z
→ wilcox.test (z, mu=0)
∴ ~~Rati~~ Pvalue = 0.1756
Accept H_0.

Neat

Practical 9: Anova

Q1] The following data given the effect of 3 treatment

T_1 : 2, 3, 7, 2
T_2 : 10, 8, 7, 5, 10
T_3 : 10, 13, 14, 13, 15

Test the hypothesis that all treatment are equally effective

$H_0 = T_1 = T_2 = T_3$
$H_1 = T_1 \; T_2 \; T_3$

```
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(values ~ Ind, data=e)
Oneway.test(values ~ ind, data=e)
```

p-value = 0.0006232.
Reject H_0

Q2] The life of different brands of tyres is given. Test whether the average life of all the tyres is same

~~The~~ 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, 17, 22, 24)
b = c(19, 15, 17, 20, 18, 17)
c = c(21, 29, 22, 17, 20)
d = c(15, 14, 18, 16, 14, 18)
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 n ind, data = e, var.equal = True)
p-value = 0.004088
Reject H_0

3) There types of wax is applied for title protection of cover and no. of days of protections were noted. Test whether there are equality effective.

H_0: Equally effective
H_1: 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, q = b = r = c)
m

e = ~~dat~~stack(m)
e
Oneway.test(values, data = e)
p-value = 0.03822
∴ Reject Ho

4) An experiment was conducted on 8 person and the observation are noted. Test hypothesis that all group have equal result.

Ho: Equal result on their health
H_1: Not equal result
a = c(23, 26, 28, 58, 32, 29)
b = c(22, 27, 29, 34, 46, 48, 65)
c = c(59, 66, 38, 59, 56, 60, 56, 62)

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

a = as.matrix(d)
e = stack(d)
aov(values ~ ind, data = e)
One way.test(values ~ ind, data = e)
P.value = 0.01633

∴ Reject Ho.