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Roll No-12

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**Experiment No -02**

**Topic**- Tracing a power curve for testing the mean of Normal Distribution.

**Problem** –A random sample of size 100 is drawn from N where = 25. Draw the power curve for testing

Against

1. (2) (3)

Use the level of significance as .

**Theory and Calculation**-

Using Neyman’s pearson fundamental lemma, the critical region is given by-

W = {x :

Here, f(x, = , - , -,

Therefore =

⇒

⇒

⇒logk

⇒

⇒

⇒

⇒, where

Case I: When then the critical region is

Case II: When then the critical region is

1. We are to test The critical region for testing this is given by

where is a constant to be determined such that

To obtain the value of , we need the following R command

k1=qnorm(0.99,,5/10)

k1

37.41317

Thus the critical region is 37.41317}

Power of the test is given by=1-β=

37.41317

=1-37.41317

Now to draw the power curve we construct the following table using the following R command-

|  |  |
| --- | --- |
| Trial values of µ(>) | Power |
| 37.00 | 0.2043034 |
| 37.05 | 0.2338128 |
| 37.10 | 0.2655434 |
| 37.15 | 0.2993233 |
| 37.20 | 0.3349272 |
| 37.25 | 0.3720806 |
| 37.30 | 0.4104654 |
| 37.35 | 0.4497283 |
| 37.40 | 0.4894899 |
| 37.45 | 0.5293564 |
| 37.50 | 0.5689306 |
| 37.55 | 0.6078240 |
| 37.60 | 0.6456684 |
| 37.65 | 0.6821260 |
| 37.70 | 0.7168984 |
| 37.75 | 0.7497337 |
| 37.80 | 0.7804317 |
| 37.85 | 0.8088461 |
| 37.90 | 0.8348854 |
| 37.95 | 0.8585107 |
| 38.00 | 0.8797328 |
| 38.05 | 0.8986066 |
| 38.10 | 0.9152251 |
| 38.15 | 0.9297124 |
| 38.20 | 0.9422161 |

**Programming in R for case 1**

sigma=5

sigma

n=100

n

sd=sigma/sqrt(n)

sd

k1=qnorm(0.99,36.25,sd)

k1

mu=c(37.00,37.05,37.10,37.15,37.20,37.25,37.30,37.35,37.40,37.45,37.50,37.55,37.60,37.65,37.70,37.75,37.80,37.85,37.90,37.95,38.00,38.05,38.10,38.15,38.20)

mu

power=mat.or.vec(25,1)

power1=mat.or.vec(25,1)

for(i in 1:25){

power[i]=pnorm(k1,mu[i],sd)

power

power1[i]=1-power[i]}

power1

plot(mu,power1)

**Power curve for case 1**



ii) Here we are to test The critical region for testing this is given by

where is a constant to be determined such that

To obtain the value of , we need the following R command

k2=qnorm(0.01,36.25,5/10)

k2

35.08683

Thus the critical region is 35.08683}

Power of the test is given by=1-β=

Now to draw the power curve we construct the following table considering different trail values

|  |  |
| --- | --- |
| Trial values for | Power |
| 30.50 | 1.0000000 |
| 30.70 | 1.0000000 |
| 30.90 | 1.0000000 |
| 31.10 | 1.0000000 |
| 31.30 | 1.0000000 |
| 31.50 | 1.0000000 |
| 31.70 | 1.0000000 |
| 31.90 | 1.0000000 |
| 32.10 | 1.0000000 |
| 32.30 | 1.0000000 |
| 32.50 | 0.9999999 |
| 32.70 | 0.9999991 |
| 32.90 | 0.9999939 |
| 33.10 | 0.9999646 |
| 33.30 | 0.9998240 |
| 33.50 | 0.9992473 |
| 33.70 | 0.9972285 |
| 33.90 | 0.9911934 |
| 34.10 | 0.9757893 |
| 34.30 | 0.9422161 |
| 34.50 | 0.8797328 |
| 34.70 | 0.7804317 |
| 34.90 | 0.6456684 |
| 35.10 | 0.4894899 |
| 35.30 | 0.3349272 |

**Programming in R for case 2**

sigma=5

sigma

n=100

n

sd=sigma/sqrt(n)

sd

k2=qnorm(0.01,36.25,sd)

k2

mu=c(30.50,30.70,30.90,31.10,31.30,31.50,31.70,31.90,32.10,32.30,32.50,32.70,32.90,33.10,33.30,33.50,33.70,33.90,34.10,34.30,34.50,34.70,34.90,35.10,35.30)

mu

power=mat.or.vec(25,1)

power

for(i in 1:25){

power[i]=pnorm(k2,mu[i],sd)}

power

plot(mu,power)

**Power curve for case 2**



iii) Here we are to test The critical region for testing this is given by

where are some constants to be determined such that

Assuming that the test is equitailed, we have

=0.005

&

To obtain the values of we use the following R command:

k3=qnorm(0.005,36.25,5/10)

k3

k4=qnorm(1-0.005,36.25,5/10)

k4

Thus, the critical region is

The power of the test is given by

1-β=

=P

=(

=(

To draw the power curve we construct the following table considering different trail values.

|  |  |
| --- | --- |
| Trial values for 𝜇 ≠ 36.25 | Power |
| 30.50 | 1.0000000 |
| 30.70 | 1.0000000 |
| 30.90 | 1.0000000 |
| 31.10 | 1.0000000 |
| 31.30 | 1.0000000 |
| 31.50 | 1.0000000 |
| 31.70 | 1.0000000 |
| 31.90 | 1.0000000 |
| 32.10 | 1.0000000 |
| 32.30 | 0.9999999 |
| 32.50 | 0.9999996 |
| 32.70 | 0.9999970 |
| 32.90 | 0.9999814 |
| 33.10 | 0.9999020 |
| 33.30 | 0.9995566 |
| 33.50 | 0.9982731 |
| 33.70 | 0.9942014 |
| 33.90 | 0.9831721 |
| 34.10 | 0.9576615 |
| 34.30 | 0.9072768 |
| 34.50 | 0.8223013 |
| 34.70 | 0.6999201 |
| 34.90 | 0.5494100 |
| 35.10 | 0.3913401 |
| 35.30 | 0.2495783 |

|  |  |
| --- | --- |
| Trial values for 𝜇 ≠ 36.25 | Power |
| 37.00 | 0.1410247 |
| 37.05 | 0.1645894 |
| 37.10 | 0.1905709 |
| 37.15 | 0.2189309 |
| 37.20 | 0.2495783 |
| 37.25 | 0.2823677 |
| 37.30 | 0.3170995 |
| 37.35 | 0.3535228 |
| 37.40 | 0.3913401 |
| 37.45 | 0.4302143 |
| 37.50 | 0.4697776 |
| 37.55 | 0.5096419 |
| 37.60 | 0.5494100 |
| 37.65 | 0.5886878 |
| 37.70 | 0.6270956 |
| 37.75 | 0.6642793 |
| 37.80 | 0.6999201 |
| 37.85 | 0.7337423 |
| 37.90 | 0.7655195 |
| 37.95 | 0.7950787 |
| 38.00 | 0.8223013 |
| 38.05 | 0.8471227 |
| 38.10 | 0.8695297 |
| 38.15 | 0.8895561 |
| 38.20 | 0.9072768 |

**Programming in R for case 3**

sigma=5

sigma

n=100

n

sd=sigma/sqrt(n)

sd

k3=qnorm(0.005,36.25,sd)

k3

k4= qnorm(1-0.005,36.25,sd)

k4

mu=c(30.50,30.70,30.90,31.10,31.30,31.50,31.70,31.90,32.10,32.30,32.50,32.70,32.90,33.10,33.30,33.50,33.70,33.90,34.10,34.30,34.50,34.70,34.90,35.10,35.30,37.00,37.05,37.10,37.15,37.20,37.25,37.30,37.35,37.40,37.45,37.50,37.55,37.60,37.65,37.70,37.75,37.80,37.85,37.90,37.95,38.00,38.05,38.10,38.15,38.20)

mu

power2=mat.or.vec(50,1)

for(i in 1:50){

power2[i]=pnorm(k3,mu[i],sd)+(1-pnorm( k4,mu[i],sd)) }

power2

plot(mu,power2)

**power curve for case 3**

