**Problem Statement 2:**

**The college bookstore tells prospective students that the average cost of its**

**textbooks is Rs. 52 with a standard deviation of Rs. 4.50. A group of smart statistics**

**students thinks that the average cost is higher. To test the bookstore’s claim against**

**their alternative, the students will select a random sample of size 100. Assume that**

**the mean from their random sample is Rs. 52.80. Perform a hypothesis test at the**

**5% level of significance and state your decision.**

**Ans:**

H0: μ=52

H1: μ>52

To calculate critical Z value

Z=52.8-52/(4.5/sqrt(100)

Z=1.78

From normal distribution

Z=1.92

Z critical value less then z value so we accept null hypothesis

μ=52 is accepted means we accept null hypothesis

**Problem Statement 3:**

**A certain chemical pollutant in the Genesee River has been constant for several**

**years with mean μ = 34 ppm (parts per million) and standard deviation σ = 8 ppm. A**

**group of factory representatives whose companies discharge liquids into the river is**

**now claiming that they have lowered the average with improved filtration devices. A**

**group of environmentalists will test to see if this is true at the 1% level of**

**significance. Assume \ that their sample of size 50 gives a mean of 32.5 ppm.**

**Perform a hypothesis test at the 1% level of significance and state your decision.**

**ANS:**

H0 :μ=34

H1: μ not=34

Critical z = 1.32

Z from table = 2.34

The z critical is less than z value so accept null hypothesis

So they claimed is true, they are dumping less chemicals

**Problem Statement 4:**

**Based on population figures and other general information on the U.S. population,**

**suppose it has been estimated that, on average, a family of four in the U.S. spends**

**about $1135 annually on dental expenditures. Suppose further that a regional dental**

**association wants to test to determine if this figure is accurate for their area of**

**country. To test this, 22 families of 4 are randomly selected from the population in**

**that area of the country and a log is kept of the family’s dental expenditure for one**

**year. The resulting data are given below. Assuming, that dental expenditure is**

**normally distributed in the population, use the data and an alpha of 0.5 to test the**

**dental association’s hypothesis.**

**1008, 812, 1117, 1323, 1308, 1415, 831, 1021, 1287, 851, 930, 730, 699,**

**872, 913, 944, 954, 987, 1695, 995, 1003, 994**

**ANS:**

H0: :μ=1135

H1 not= 1135

Z critical = -2.02

Z from table= 1.96

Z critical is greater than z value so we reject null hypothesis

So average dental rate is not accurate

**Problem Statement 5:**

**In a report prepared by the Economic Research Department of a major bank the**

**Department manager maintains that the average annual family income on Metropolis**

**is $48,432. What do you conclude about the validity of the report if a random sample**

**of 400 families shows and average income of $48,574 with a standard deviation of**

**2000?**

**ANS:**

H0 :μ= 48432

H1: μ not = 48432

Z value is 1.42

Z critical from table 1.645

Z value less than z critical so we failed to reject null hypothesis.

So the report claimed is true

**Problem Statement 6:**

**Suppose that in past years the average price per square foot for warehouses in the**

**United States has been $32.28. A national real estate investor wants to determine**

**whether that figure has changed now. The investor hires a researcher who randomly**

**samples 19 warehouses that are for sale across the United States and finds that the**

**mean price per square foot is $31.67, with a standard deviation of $1.29. assume**

**that the prices of warehouse footage are normally distributed in population. If the**

**researcher uses a 5% level of significance, what statistical conclusion can be**

**reached? What are the hypotheses?**

**ANS:**

H0 :μ= 32.38

H1 :μnot= 32.38

Z value is -2.1

Z critical from table is 1.96

It’s in rejection region so we reject null hypothesis so average price of property in that region is changes

**Problem Statement 7:**

We may find this probability as

  Pr(X < 48.5 when μ= 50) + Pr(X > 51.5 when μ= 50)

The z‐values that correspond to the critical values 48.5 and 51.5 are  z1 =(48.5‐50)/0.79 =‐1.90

and z2= (51.5‐50)/0.79m=1.90.   Therefore α = Pr(Z 1.90) = 0.028717 + 0.028717 = 0.057434.

This implies that 5.76% of all random samples would lead to rejection of the hypothesis when the true mean burning rate is really 50 centimeters per second.

From inspection of the above figure, notice that we can reduce α by widening the acceptance region. For example, if we make the critical values 48 and 52, the value of α is

α = Pr(Z < (48‐50)/0.79) +Pr(Z>(52‐50)/0.79) = 0.0057 + 0.0057 = 0.0114

We could also reduce α  by increasing the sample size n.

If n=16, s=2.5, σ / n =0.625, and using the original critical region ,

we find z1 = (48.5 – 50)/0.625 = ‐2.40 and z2=(51.5‐50)/0.625 = +2.40

which produces an   α = Pr(Z2.4) = 0.0082 + 0.0082 =0.0164.

β= Pr(48.5 ≤ X ≤51.5 when μ= 52) The z‐values corresponding to 48.5 and 51.5 when μ= 52 are z1= (48.5‐52)/0.79=‐4.43 and z2= (51.5‐52)/0.79 = ‐0.63 so   β = Pr( ‐4.43 < Z <-0.63)=0.2643

The power of this test is defined as 1‐β = 0.7357 and this is the probability of rejecting H0: μ=50 when the true mean is μ=52. In general we would be happy with experiments that produced confidence level, CL = 1‐α = 0.9 and Power = 1‐β = 0.80.

As shown in figure below, the z‐values corresponding to 48.5 and 51.5 when μ=50.5 are z1 = ‐2.53 and z2 = 1.27 which calculates to be 0.8923

1‐β = 0.1077

**Problem Statement 8:**

**Find the t-score for a sample size of 16 taken from a population with mean 10 when**

**the sample mean is 12 and the sample standard deviation is 1.5.**

**ans:**

t = [ x - μ ] / [ s / sqrt( n ) ]  
t = ( 12 - 10 ) / [ 1.5/ sqrt( 16) ]  
t = 2/ 0.355 = 5.33

**Problem Statement 10:**

**If a random sample of size 25 drawn from a normal population gives a mean of 60**

**and a standard deviation of 4, find the range of t-scores where we can expect to find**

**the middle 95% of all sample means. Compute the probability that (−t0.05 <t<t0.10).**

**Ams:**