STATISTICS AND PROBABILITY ASSIGNMENT

1. The maximum weight that an elevator in an apartment complex can accommodate is 800kg. The average adult weight be about 70 kgs with a variance of 200. What is the probability that the lift safely reaches the ground when there are 10 adults in the lift?

Solution:

Given mean= 70

Variance = 200

Mean for 10 adults = 10(70) = 700

Variance for 10 adults = 10(200) = 2000

Standard deviation (sd) = square root of 2000​= 44.72

If the weight > 800 kg causes the elevator to "unsafely" reach the ground, then we can find the upper tail of our normal distribution:

P (Weight of 10 adults > 800 kg).

Z-score = (X-mu)/SD = (800-700)/44.72 = 2.24 -*Z*−*score*

Hence P (Z <2.24), using z table we get 0.9875 or 98.75%

Hence it is safe to reach the ground when there are 10 adults in the lift.

1. The life of a 60- watt light bulb in hours is known to be normally distributed with σ = 25 hours. Create 5 different random samples of 100 bulbs each which have a mean life of x\_bar ~ 1000 hours and perform one-way ANOVA with state it.

SOLUTION

The total sample size is *N*=500. Therefore, the total degrees of freedom are:

dftotal​=500−1=499

The between-groups degrees of freedom are df between =5-1=4, and the within-groups degrees of freedom are:

dfwithin​=dftotal​−dfbetween​=499−4=495

∑​Xij=499712

∑(X)^2=499691630

SStotal​=i,j∑​Xij2​−N1​(i,j∑​Xij​)2=267464.112

SSwithin​=266084.42

SSbetween​=1379.692

MSbetween​=dfbetween​SSbetween​​=41379.692​=344.923

MSwithin​=dfwithin​SSwithin​​=495266084.42​=537.544

F=MSwithin​MSbetween​​=537.544344.923​=0.642

The following null and alternative hypotheses need to be tested:

H0:μ1​=μ2​=μ3​=μ4​=μ5​

H1: Not all means are equal.

The above hypotheses will be tested using an F-ratio for a One-Way ANOVA.

Based on the information provided, the significance level is α=0.05, and the degrees of freedom are 4df1​=4 and df2​=4, therefore, the rejection region for this F-test is

R= {F: F>Fc​=2.39}

Test Statistics

F=MSwithin /​ MSbetween​​=537.544344.923​=0.642

Since it is observed that F=0.642<2.39=Fc, F=0.642<2.39=Fc​, it is then concluded that the null hypothesis is not rejected. Therefore, there is not enough evidence to claim that not all 5 population means are equal, at α=0.05 significance level.

Using the P-value approach: The p-value is p=0.633, and since p=0.633≥0.05,

It is concluded that the null hypothesis is not rejected. Therefore, there is not enough evidence to claim that not all 5 population means are equal, at α=0.05 significance level.