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

Hence Mean for 10 adults = 10(70)= 700

Variance for 10 adults = 10(200)= 2000

## Therefore standard deviation sd =  = 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

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 has a mean life of x\_bar ~ 1000 hours and perform one-way ANOVA with state it.**

**Solution:**

**Given:** 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:

dfbetween= 5-1=4

and the within-groups degrees of freedom are:

dfwithin= dftotal- dfbetween

=499-4=495

∑​*Xij*​=499712

∑​*Xij*2​=499691630

*SStotal*​=*i*,*j*∑​*Xij*2​− *1/N\**​(*i*,*j*∑​*Xij*​)2 =267464.112

*SSwithin*​=266084.42

*SSbetween*​=1379.692​

*MSbetween*​= *SSbetween/* dfbetween

= 1379.692​/4 =344.923

*MSwithin=* *SSwithin/* dfwithin

=266084.42- 495 =537.544

*F = SSbetween/ SSwithin*​

= 1379.692/ 266084.42 = 0.642

The following null and alternative hypotheses need to be tested:

*H*0​: *μ*1​=*μ*2​=*μ*3​=*μ*4​=*μ*5​  
*H*1​: 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 *df*1​=4 and *df*2​=4, therefore, the rejection region for this F-test is

*R*={*F*: *F*>*Fc*​ =2.39}.

Test Statistics

*F= MSbetween/MSwithin*

*=*344.923/537.544=0.642

Since it is observed that  *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 the *α*=0.05 significance level.

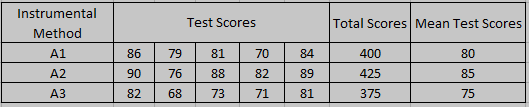
**Using the P-value approach:**

The p-value is  *p*=0.633

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 the *α*=0.05 significance level.

* 1. Fifteen trainees in a technical program are randomly assigned to three different types of instructional approaches, all of which are concerned with developing a specified level of skill in computer-assisted design. The achievement test scores at the conclusion of the instructional unit are reported in Table along with the mean performance score associated with each instructional approach. Use the analysis of variance procedure to test the null hypothesis that the three-sample means were obtained from the same population, using the 5 percent level of significance for the test.



**Solution:**

We have the sample of the scores of 15 students (First Group, Second Group, Third Group). Each group consists of 5 students.

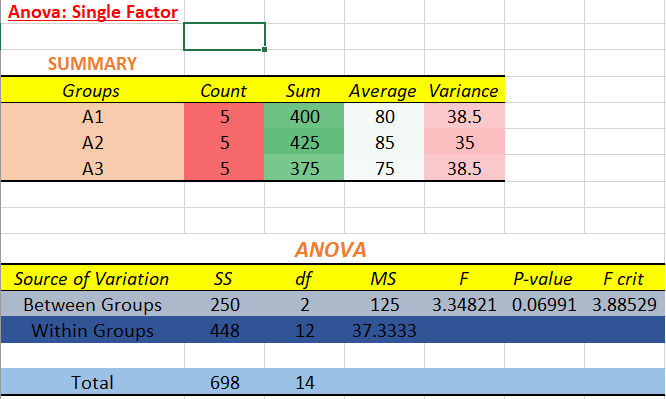
We calculate the mean of each group.

We should find out whether these means are different significantly (whether they were chosen from the different populations)

*α*=0.05.

*H*0​: *μ*1​=*μ*2​=*μ*3​=*μ*4​=*μ*5​  
*H*1​: Not all means are equal.

**Using Single-Factor ANOVA in Excel** , we get



The F value calculated was 3.34.

This is less than the stated critical value (Fcrit ) of 3.88, and the probability of obtaining this result by chance (P-value) was calculated as 0.0699 (6.99% to three significant figures).

**We conclude that there was not a significant difference in means and the three-sample means were obtained from the same population, since P >0.05.**