Math project 19|July|2021

# Statistics and Probability Assignment

* Questions:-

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

⇒ Given mean = 70

Variance = 200, x = 800

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

Variance for 10 adults = 10(200) = 2000

therefore standard deviation $sd = \sqrt{2000} = 44.72$

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

P (weight of 10 adults > 800kg)

$$z\text{- score} = \frac{(x-mu)}{SD} = \frac{(800-700)}{44.72} = 2.24$$

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

∴ Hence it is safe to reach the ground

④ The life of 60-watt light bulb in hours is known to be normally distributed with $\sigma = 25$ 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.

⇒ The total sample size is $N = 500$

Therefore, the total degrees of freedom are

$df_{total} = 500 - 1 = 499$

The between-groups degrees of freedom are

$df_{within} = df_{total} - df_{between} = 499 - 4 = 495$

$\sum_{i,j} x_{ij} = 499712$

$\sum_{i,j} x_{ij}^2 = 499691630$

$SS_{total} = \sum_{i,j} x_{ij}^2 - \frac{1}{N}\left(\sum_{i,j} x_{ij}\right)^2 = 267464.112$

$SS_{within} = 266084.42$

$SS_{between} = 1379.692$

$MS_{between} = \frac{SS_{between}}{df_{between}} = \frac{1379.692}{4} = 344.923$

$MS_{within} = \frac{SS_{within}}{df_{within}} = \frac{266084.42}{495} = 537.544$

$F = \frac{MS_{between}}{MS_{within}} = \frac{344.923}{537.544} = 0.642$

The following null and alternative Hypotheses need to be tested:

$H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

$H_1$: Not all means are equal

The above hypothesis will be tested using an f-ratio for one-way ANOVA.

Based on the information provided, the significance level is $\alpha = 0.05$, and the degrees of freedom are $df_1 = 4$ and $df_2 = 4$, therefore, the rejection region for this f-test is $R = \{F : F > f_c = 2.39\}$.

Test $f = \frac{MS_{between}}{MS_{within}} = \frac{344.923}{537.544} = 0.642$

Since it is observed that
$F = 0.642 < 2.39 = f_c$, it is then concluded that the null hypothesis is not rejected

Therefore, there is not enough evidence to claim that not all 5 ~~questions~~ way · population means are equal, at then $\alpha = 0.05$ significance level.

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 the $\alpha = 0.05$