

Statistics and Probability Assignment

Q. ①

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

Ans:

Given : Mean = 70

$$\therefore \text{mean for 10 adults} = 70 \times 10 \\ (-4) \quad \quad \quad = 700$$

Variance = 200

$$\therefore \text{variance for 10 adults} = 200 \times 10 \\ = 2000$$

We know,

$$\text{Standard deviation } (\sigma) = \sqrt{\text{variance}}$$

$$\sigma = \sqrt{2000}$$

$$\sigma = 44.72$$

here, max. weight that an elevator in an apartment complex can accommodate is given i.e., 800 kg. (x).

It means, If the weight > 800 kg. then the elevator unsafely reach the ground, but we want probability of lift safely reaches the ground i.e., $P(\text{weight of adults} < 800 \text{ kg})$

$$\therefore Z = \frac{x - \mu}{\sigma}$$

where,

z = standard score

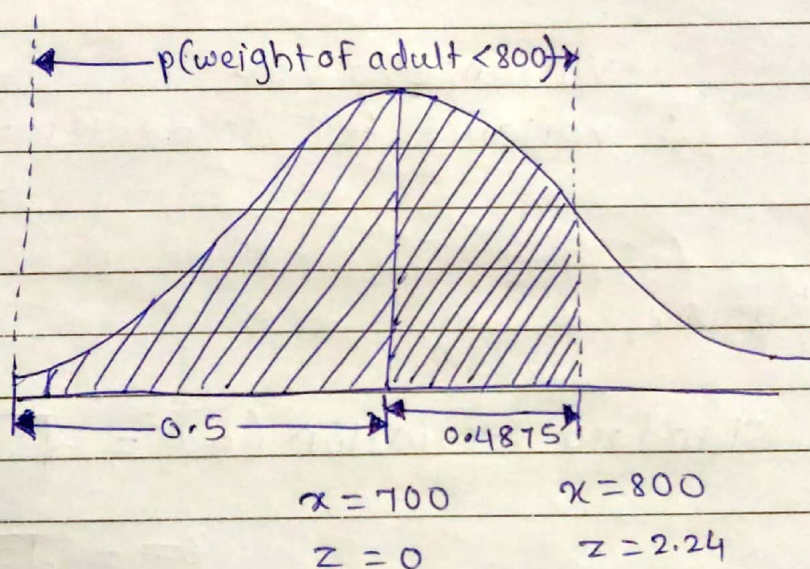
x = observed value

μ = mean

σ = standard deviation

$$\therefore z = \frac{800 - 700}{44.72}$$

$$\therefore \boxed{z = 2.24}$$



$$\therefore p(\text{weight of 10 adults} < 800) = 0.5 + 0.4875$$

$$= 0.9875$$

\therefore Probability of (weight of 10 adults < 800) is 98.75%

Q2

The life of a 60-watt light bulb in hours is known to be normally distributed with $\sigma = 25$ hr. Create 5 different random samples of 100 bulbs each which has a mean life of $\bar{x} \sim 1000$ hrs. and perform one-way ANOVA with state it

Ans:

Given: Standard deviation = 25
(3)

(20 marks)

We have to create 5 random samples of 100 bulbs each with mean ≈ 1000 hrs.

Perform one way ANOVA

Here,
 df_b - degree of Freedom (between)
 df_w - degree of freedom (within)
 ss_w - sum of squares (within)
 ss_b - sum of squares (within)

Here, $n = 500$ (no. of samples)
 $K = 5$ (random variable)

degree of freedom (df_b) between = $K - 1$
 $= 5 - 1$

$$\boxed{df_b = 4}$$

degree of freedom (df_w) within = $n - K$
 $= 500 - 5$

$$\boxed{df_w = 495}$$

As the sample is too large it is very complicated & difficult to calculate & it is very time consuming, so we use excel for calculating ss_w & ss_b .

⇒ Here, mean of each sample is ,

$$\bar{x}_1 = 1001$$

$$\bar{x}_2 = 1003.3$$

$$\bar{x}_3 = 999.3$$

$$\bar{x}_4 = 1000.8$$

$$\bar{x}_5 = 1002.0$$

From excel sheet we get,

$$SSW = 292239.29 \quad \& \quad SSB = 31245.64$$

Next step is finding F-ratio

Here,

MSSW - mean sum of squares (within)

MSSB - mean sum of squares (between)

$$\therefore MSSB = \frac{\text{sum of squares between groups (SSB)}}{\text{degree of freedom}}$$

$$= \frac{31245.64}{4}$$

$$\therefore MSSB = 7811.41$$

$$\therefore MSSW = \frac{\text{sum of squares within group (SSW)}}{\text{degree of freedom}}$$

$$= \frac{292239.29}{495}$$

$$\therefore MSSW = 590.38$$

find, $F = \frac{MSSB}{MSSW}$

$$= \frac{7811.41}{590.38}$$

$$F = 13.23$$

Now, find critical value using F-table
(CV)

$$F(4, 495) = 2.3719$$

hence, F-value > C.V i.e, $13.23 > 2.3719$

hence reject H_0

