Probability and Statistics Project

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1. Project Topic:

(a) **Statement:** 70% of the Ashokans (from UG21, UG20, and ASP20) believe that the quality of the laundry services has degraded since the induction of the UG22 batch.

(b) **Null hypothesis(H_0):** $p = 0.7$, where is the probability of an individual believing that the quality of the laundry services has degraded since the induction of the UG22 batch.

(c) **Alternative hypothesis(H_1):** $p \neq 0.7$

2. Data Collection:

We collected data through an online google form (https://forms.gle/2KiSb4e4KaPkTXdX6).

This form was floated through email to three Undergraduate batches (UG21, UG20, ASP20). The other batches were not included as they could not have experienced a change in the laundry service as they have been freshly inducted.

The randomness of the sample:

"Techowash" manages all laundry services in the university. Laundry is submitted on biweekly bases in two locations (SH1 and SH2), based on your gender. Since both locations are operated under the same company which uses the same mechanism while rendering the service, we assume that there is no difference in the outcome.

Our sample was sent out to all the three batches through the student government. Since there was no compulsion to fill out the survey, therefore our sample was completely randomized. There was no screening or bias to prevent anyone from filling out the form or not filling out the form. Furthermore, none of the samples were pressured into choosing any options.

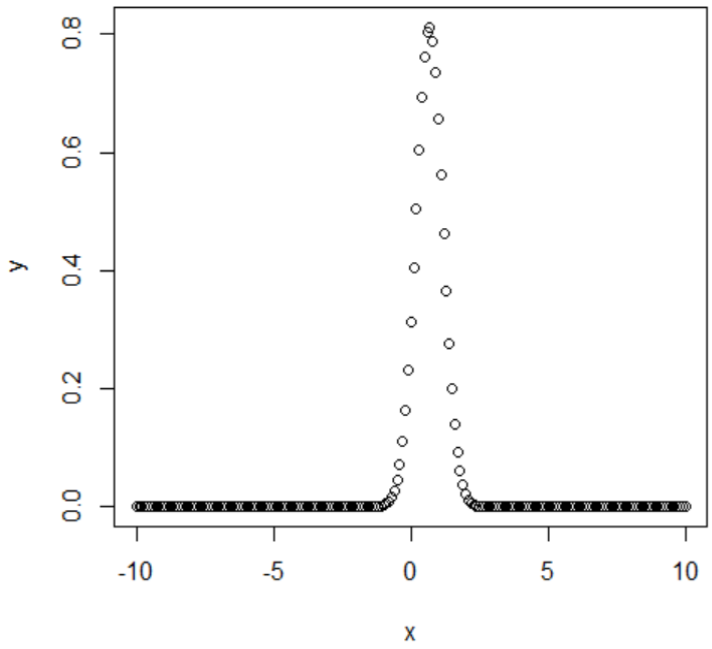

Figure 1: Normal distribution of the sample.

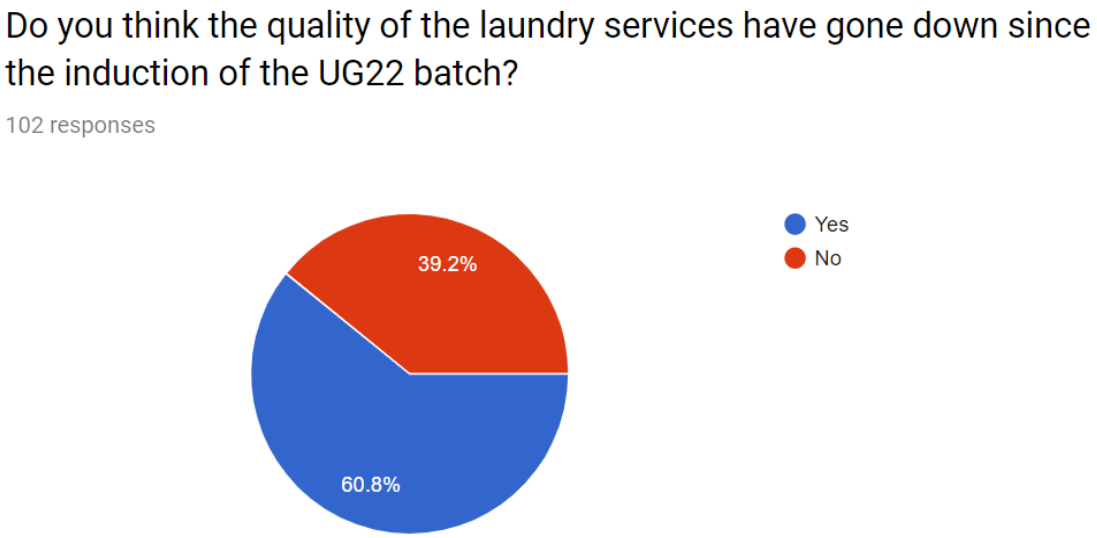

Figure 2: Summary of the responses

3. Testing:

For $i = 1$ to n, let X_i measure if the i^{th} selected person believes that the quality of the laundry services has gone down since the induction of the UG22 batch. Then,

$X_i \sim$ Bernoulli $(p = 0.7)$ and $\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$

We collected data and we got 102 responses. So, $n = 102$.

From Sample, sample mean is $\bar{X} = 0.608$, and sample standard deviation $(S) = 0.491$

Now, for $n = 102$, we have $\bar{X} \sim \text{N}(0.7, \frac{0.491}{\sqrt{102}})$

Then,

$$\begin{aligned} \text{Sample Statistic} &= \frac{0.608 - 0.7}{\frac{0.491}{\sqrt{102}}} \\ &= -1.89 \end{aligned}$$

For (-1.89), from the t-distribution table, the corresponding p-value is 0.0308.

SN.	Sample Statistics	p-value	Significance Level (α)	Power of the test$(1 - \beta)$	Accept or Reject
1	$\frac{X-m}{S/n}$	0.0308	10%	–	$(0.0308 < 0.05)$ Reject
2	$\frac{X-m}{S/n}$	0.0308	5%	–	$(0.0308 > 0.025)$ Accept
3	$\frac{X-m}{S/n}$	0.0308	2%	–	$(0.0308 > 0.01)$ Accept

4. Conclusion:

At 5% significance level, the null hypothesis got accepted which means 70% of the Ashokans (from UG21, UG20, and ASP20) believe that the quality of the laundry services has degraded since the induction of the UG22 batch.