INFERENTIAL STATISTICS

1. (A) 0
2. (b) accepted
3. (b) accepted
4. (B) 33
5. (C) statistic
6. (A) $t = \frac{\bar{x} - \mu}{\left(\frac{s}{\sqrt{n}}\right)}$
7. $t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n-1}}}$
8. (A) increases then sampling distribution must approach normal distribution
9. (A) 20
10. (D) 2024
11. (A) Systematic sampling
12. (b) $\bar{x}$
13. (A) $\frac{\bar{x} - \mu}{\left(\frac{s}{\sqrt{n}}\right)}$
14. b) Inferior quality
15. (B) 33
16. c) Statistic
17. (D) Sample
18. (B) sampling distribution
19. Consider

Given:

$H_0 : \mu = 35$, $H_1 : \mu \neq 35$

$n = 81$, $\bar{x} = 37.5$, $s = 5$, $\alpha = 0.05$, $Z_{\text{critical}} = \pm 1.96$

Test Statistic:

$$Z = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{37.5 - 35}{5/9} = 4.5$$

Decision:

Since $|Z| = 4.5 > 1.96$, **reject** H_0.

Conclusion:

The population mean is significantly different from 35 at the 5% level.

20. Fil

Sol.

(a) $t = 0$	½
(b) $-\infty$ to $+\infty$	½
(c) 0	½
(d) greater than 1	½

21. A bulb

Hypotheses:

$H_0 : \mu = 20, \quad H_1 : \mu \neq 20$

Given data:

Sample: 24, 22, 27, 18, 20, 24, 22, 19

$n = 8, \quad \alpha = 0.05, \quad t_{\text{critical}} = 2.36$

Calculations:

$$\bar{x} = \frac{176}{8} = 22, \quad s = \sqrt{\frac{62}{7}} \approx 2.976$$

$$t = \frac{22 - 20}{2.976/\sqrt{8}} \approx 1.90$$

Decision:

$|t| = 1.90 < 2.36 \Rightarrow$ Do not reject H_0

Conclusion:

Insufficient evidence to reject the factory's claim.

$\boxed{\text{Accept } H_0}$

22. A

$H_0: \mu = 0.50\ mm$

$H_1 : \mu \neq 0.50\ mm$

Thus a two-tailed test is applied under hypothesis H_0, we have

$t = \frac{\bar{X}-\mu}{s}\sqrt{n-1} = \frac{0.53-0.50}{0.03} \times 3 = 3.$ 1 Mark

Since the calculated value of t i.e. $t_{cal}(=3) > t_{tab}(=2.262)$, the null hypothesis H_0 can be rejected. Hence, we conclude that machine is not working properly. 1 Mark

23. A

$E(\bar{X}) = 60kg$	1
Standard deviation of $\bar{X} = SE(\bar{X}) = \frac{\sigma}{\sqrt{n}} = \frac{9}{6} = 1.5\ kg$	1

24. A

Sol.	$\bar{x} = 0.742,\ \mu = 0.7$ $n = 10, s = 0.04$	½
	H_0: Null hypothesis : If there is no significant difference between $\bar{x}$ and μ H_1: Alternate hypothesis : If there is a significant difference between $\bar{x}$ and μ $t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n-1}}} = \frac{0.742-0.7}{\frac{0.04}{\sqrt{9}}} = 3.15$	1½
	Df = 9 and $t_9(0.05) = 2.262$ Since $\lvert t \rvert = 3.15 > 2.262$	½
	$\therefore$ Null hypothesis is rejected	

25. The

Sol. Here, $\mu_0 = 50, \bar{x} = 55, n = 20$ and $S = 10$ $(\frac{1}{2})$

$H_0 : \mu = 50$ (The advertisement campaign was not successful)

$H_\alpha : \mu > 50$ (The advertisement campaign was successful)

The test statistic t is given by

$$t = \frac{\bar{x}-\mu}{\frac{S}{\sqrt{n}}} = \frac{55-50}{\frac{10}{\sqrt{20}}} = \frac{2\sqrt{5}}{2} = \sqrt{5} = 2.24$$ $(1\frac{1}{2})$

Degree of freedom $= 20 - 1 = 19$

Here, $t > t_{19}(0.05)$ as $2.24 > 1.729$ $(\frac{1}{2})$

$\Rightarrow$ null hypothesis is rejected

i.e., Advertising campaign was successful $(\frac{1}{2})$

26. The

Sol. We are given

$\mu = 50$, $\bar{x} = 55$, SD $= 10$, $n = 20$ **(1)**

H_0: $\mu = 50$

H_1: $\mu > 50$

$$t = \frac{\bar{x}-\mu}{\frac{SD}{\sqrt{n}}} = \frac{55-50}{\frac{10}{\sqrt{20}}} = 2{\cdot}236$$ **(2)**

$$t_{\text{cal value}} > t_{\text{tab value}}$$

Hence H_0 is rejected.

So, Advertising Campaign was successful.

27. Ten

Solution:

We are given $n = 10$, $\bar{x} = 11.8$ kg and s = 0.15 kg

Let Null hypothesis be $H_0 = \mu = 12$ kg, and

Alternate hypothesis be H_1 ; $\mu \neq 12$ kg **[1]**

Under H_0, the test statistic is

$$t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n-1}}} = \frac{11.8-12}{\frac{0.15}{3}} = -4$$ **[1]**

Since the tabulated value of t for *d.f.* = 9 is $t_{0.05} = 2.26$ and the calculated $|t|$ is much greater than the tabulated value, null hypothesis is rejected. Thus, we conclude that the sample mean differs significantly from the intended mean of 12 kg. **[1]**

28. Ten

Ans		
	Null hypothesis H_0 : There is no significant difference between the sample mean and population mean.	½
	Alternate hypothesis H_1 : The sample mean is not the same as population mean.	
	Let the sample statistic t is given by $t=\dfrac{\bar{X}-\mu}{s/\sqrt{n}}$	
	For the given data : $n=10,\ \sum_{i=1}^{10} x_i=1160, \bar{X}=116$ and $\sum_{i=1}^{10}\left(x_i-\bar{X}\right)^2=864$	1
	$\Rightarrow s=\sqrt{\dfrac{1}{n-1}\sum_{i=1}^{10}\left(x_i-\bar{X}\right)^2}=\dfrac{\sqrt{864}}{3}$	
	Thus, $t=\dfrac{116-110}{\frac{\sqrt{864}}{3}}\times\sqrt{10}=\dfrac{\sqrt{15}}{2}\approx 2$	1
	Since $\lvert t\rvert<2.262$, the null hypothesis is accepted.	½
	i.e. mean height of the students of the college is 110 cm.	

29. Hole

$H_0: \mu = 1.84$ cm (machine is working properly) $H_1: \mu \neq 1.84$ cm (machine is not working properly)	½
For sample: $\bar{x} = 1.85$ cm and $s = \sqrt{0.0064} = 0.08$ cm At $\alpha = 0.05$ and df = 15	½
$t = \dfrac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}} = \dfrac{1.85-1.84}{\frac{0.08}{\sqrt{16}}} = \dfrac{0.01}{0.08} \times 4 = 0.5$	1
$\lvert t_{cal}\rvert = 0.5 < t_{critical} = 2.131$ at $\alpha = 0.05$ and df = 15	½
∴ null hypothesis is accepted, there is no significant difference between the sample mean and the population mean, hence machine is working properly.	½

30. The

Here, population mean $(\mu) = 25$

Sample mean $(\bar{x}) = \frac{\sum x_i}{n} = \frac{138}{6} = 23$ ½

Sample size $(n) = 6$

Consider, Null hypothesis $\mathbf{H_0}$: There is no significant difference between the sample mean and the population mean i.e., $(\mu_1 = \mu_2)$.

Alternate hypothesis $\mathbf{H_\alpha}$: There is no significant difference between the sample mean and the population mean i.e., $(\mu_1 \neq \mu_2)$.

Values of $(x_i - \bar{x})^2$ are $1, 9, 49, 9, 9$ and 25

$\therefore s = \sqrt{\frac{102}{5}} = 4.52$ 1

Now, $t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}} = \frac{23-25}{\frac{4.52}{\sqrt{6}}}$

$= -1.09$ 1

$\Longrightarrow \ |t| = 1.09$

Since, calculated value $|t| = 10.763 <$ tabulated value $t_5(0.01) = 4.132$

So, the null hypothesis is accepted. ½

Hence, the manufacturer's claim is valid at 1% level of significance.

31. A

Define Null hypothesis H_0 and alternate hypothesis H_1 as follows:

$H_0: \mu = 0.50\ mm$

$H_1: \mu \neq 0.50\ mm$ 1

Thus a two-tailed test is applied under hypothesis H_0, we have 1

$t = \frac{\bar{X}-\mu}{S}\sqrt{n-1} = \frac{0.53-0.50}{0.03} \times 3 = 3$

Since the calculated value of $t = 3$ does not lie in the internal $-t_{0.025}$ to $t_{0.025}$ i.e., -2.262 to 2.262 for 10-1= 9 degree of freedom

So we Reject H_0 at 0.05 level. Hence we conclude that machine is not working properly. 1