HYPOTHESIS TESTING

Ans ①

Step 1:- Establish Null & Alternate hypotheses

Null hypothesis: 5% to the indian children had autism.

Alternate hypothesis: More than 5% to the indian children had autism

$H_0 : P = 0.05$

$H_A : P > 0.05$

it is a one-tailed test since we are going to checked only one end of the experiment

Step 2:- Determine the test we are going to perform the Z-test

Step 3:- Set value of alpha (α): Since in this Proble the Significance value is not given.

$\alpha = 5\%$

$\alpha = 0.05$

Step 4:- Establish decision rule for Z-critical

if Z-critical < Z-score

we will reject the null hypothesis

for P-value

if P-value < Significance value

we will reject null hypothesis.

FOR P-value
if P-value < significance value
we will reject null hypothesis

Step 5: Data Gathering.

Examined 384 children and found 46 showed signs of autism
5% of children had autism

Step 6:- Analysing the data

$P = 0.05$, $n = 384$

$\hat{P} = \frac{46}{384} = 0.11$

$\boxed{\hat{P} = 0.11}$

$q = 1 - P$

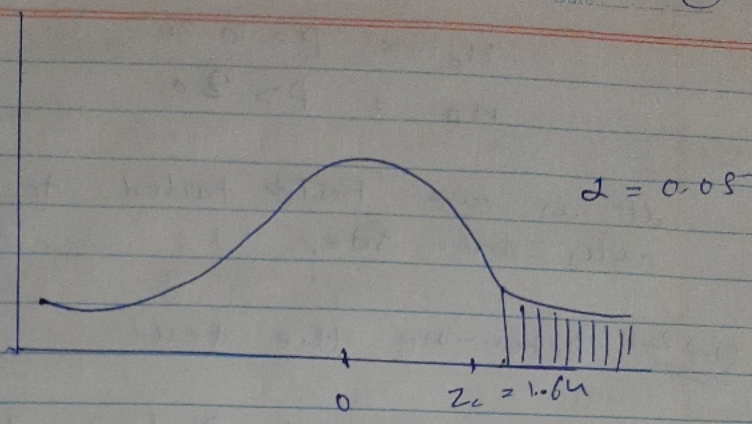
$= 1 - 0.05$

$\Rightarrow \boxed{q = 0.95}$

$$Z\text{-score} = \frac{\hat{P} - P}{\sqrt{\frac{P \cdot q}{n}}} = \frac{0.11 - 0.05}{\sqrt{\frac{0.05 \times 0.95}{384}}}$$

$$\Rightarrow \frac{0.06}{0.011}$$

$\boxed{z \text{ score} = 5.45}$



Step 7:- using Z table

Z critical = 1.64 . Z Score = 5.45

Z critical < Z Score

we reject ~~the~~ null hypothesis

So more than 5% had autism

~~Hence~~

~~So~~ So the increase in certain chemical in the environment had led to an increase in autism.

Ans (2)

Step 1: Null & Alternative hypothesis

Null hypothesis - 20% of the car to meet pollution guidance.

Alternative ~~to~~ hypothesis ; more than 20% of the car ~~fail~~ failed to meet pollution guidances

$H_0 \Rightarrow p = 0.20$

$H_A = p > 20$

It is one ~~tailed~~ tailed test as we test only one side.

Step 2: Determine the test

we are going to Perform the Z-test

Step 3: Set the Significance value,

@ Significance value = 10%.

$\alpha = 0.10$

Step 4: Establish Decision Rule,

for Z-critical,

Z-critical < Z-score (test score)

we will reject null hypothesis

for P-value,

if P-value < Significance level

we will reject our null hypothesis

Step 5: Collecting data

A Company with a fleet of 150 cars found that the emission type system of 7 out of the 22 cars tested ~~failed~~ failed to meet.

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Date: (5)

Pallution guidelines

Step 6:- Analysis of data

for Z - Score,
$$Z\text{-Score} = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$$

$p = 0.20$

$n = 22$

to calculate $\hat{p}$

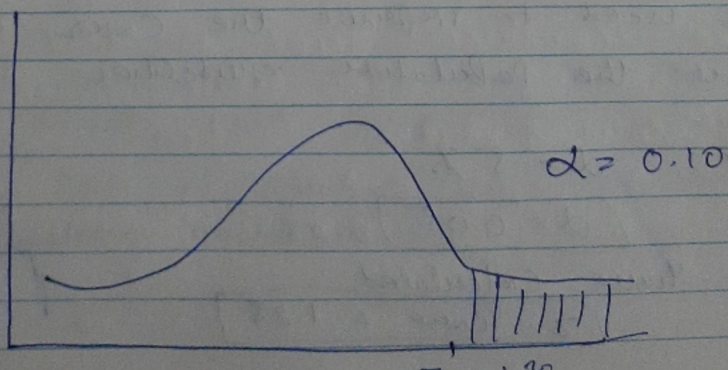
$\hat{p} = \frac{7}{22}$, $q = 1 - p$

$\boxed{\hat{p} = 0.31}$ $\boxed{q = 0.80}$

0.0853

$$Z\text{-Score} = \frac{0.31 - 0.20}{\sqrt{\frac{0.20 \times 0.80}{22}}}$$

$\boxed{Z\text{-Score} = 1.28}$



By Z-table,

$\boxed{Z_c = 1.3}$

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$\boxed{P\text{-value} = 1.003}$

Step 7 : take Statistical Action,

For Z- critical.

Z - critical > Z - Score

1.3 > 1.28

we will not reject the null hypothesis,
we will accept the null hypothesis.

For P- value,

P - value > Significance value

1.003 > 0.10

we will accept the null hypothesis

So, 20% of cars ~~[illegible]~~ failed to meet Population guidelines.

Step 8: we Determine Business implication

we need to Improve the Cars to meet the Population guideline.

② For, $\alpha = 5\%$.

$\boxed{\alpha = 0.05}$

we have calculated,

$\boxed{Z\text{-Score} = 1.28}$

Date:

using Z- table,

$$\boxed{Z\text{- critical} = 1.64}$$

On the basis of decision Rule,

Z - Critical > Z- Score

we,

$1.64 > 1.28$

we will accept the null hypothesis.

that, 20% of the entire fleet of the cars are failed to meet the population guidelines

③ for,

$\alpha = 1\%$

$$\boxed{\alpha = 0.01}$$

Z Score = 1.28

using Z table. Z critical = 2.33

On basis of decision rule

Z critical > Z Score

$2.33 > 1.28$

we accept null hypothesis

then 20% of cars failed to meet population guidelines.

(8)

Ans (3)

Step 1: Null hypothesis and ~~as~~ alternate hypothesis

Null hypothesis : 44% of the adult population had never smoked.

Alternative hypothesis: More than 44% of the adult population had never smoked.

$H_0 : p = 0.44$

$H_A : p > 0.44$

it is one tailed test as we test only one end.

Step 2: Determine the test

we are going to perform the Z-test

Step 3, Set the value of significance level

Since, condition level is 98%.

then, $\alpha = 2\%$.

~~$\alpha = 0.20$~~

$\boxed{\alpha = 0.02}$

Step 4:- Establish the decision rule

for z- critical

if, z - critical < z- test (test score)

we will reject null hypothesis

for P- values,

if P - value < significance value

we will reject the ~~to~~ null hypothesis

Step 5: Gathering the data

A national random sample of 891 adults were interviewed and 463 stated that they had never smoked.

Step-6: Analysis of data.

for z- Score = $\frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$

$p = 0.44$ $\quad n = 891$ $\quad \hat{p} = \frac{463}{891}$

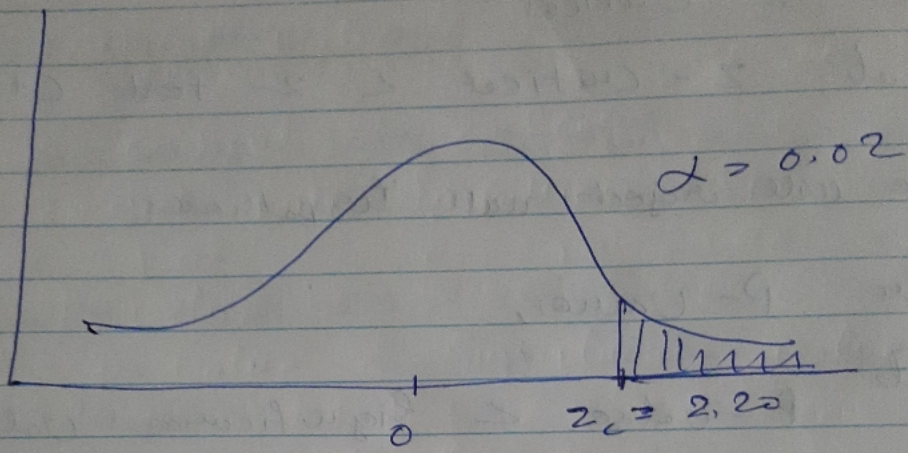
$\boxed{\hat{p} = 0.519}$

$q = 1 - p$

$\boxed{q = 0.56}$

z - Score = $\frac{0.519 - 0.44}{\sqrt{\frac{0.44 \times 0.56}{891}}}$

$\boxed{Z\text{ - Score} = 4.73}$



By using ~~Z-table~~,

$\boxed{Z\text{ - Critical} = 2.20}$

Step 7: Z Score = ~~4.27~~ 4.73
Z critical = 2.20

on the basis of decision rule,

Z-critical < Z-Score
2.20 < 4.73

we will reject the null hypothesis

Step 8 the more than 44% of the adult population never smoked.

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Date (12)

Ans (21)

Step 1: Null and Hypothesis Alternate

Null hypothesis: Distance from lens to object and distance from lens to real image is same

Alternative hypothesis: Distance from lens to object and distance from lens to real image is not same

$H_0 = \mu_A = \mu_B$

$H_A = \mu_A \neq \mu_B$

Step 2 Determine the test

we are going to perform the z-test.

Step 3: Significance value

Significance value not given so hence as default

$\alpha = 0.05$

it is a two tailed test as we check the two right and left end

$$\frac{\alpha}{2} = \frac{0.05}{2} = 0.025$$

Step 4: Establish the Decision Rule

for critical value.

if
z - critical < z - score
we reject Null hypothesis

for P- value.
if p- value < Significance value

we reject Null hypothesis.

Step 5: Data gathering

Sample mean $\bar{S}_1 = 26.6$ cm
$\bar{S}_2 = 13.8$ cm

Standard deviation for $S_1 = 0.1$ cm
$S_2 = 0.5$ cm

Step 6: Data Analysis

for two sample z- test to be performed

$\alpha = 0.05$

$\frac{\alpha}{2} = 0.025$

for distance from lens to object S_1

$S_1 = 26.6$ cm $\quad \sigma_1 = 0.1$ cm $\quad n_1 = 25$

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For distance from lens to Real image S_2

$\bar{S}_2 = 13.8$ $\sigma_2 = 0.5$ cm $n_2 = 25$

for Z score

$$Z\text{-score} = \frac{\bar{S}_1 - \bar{S}_2}{\sqrt{\frac{(\sigma_1)^2}{n_1} + \frac{(\sigma_2)^2}{n_2}}}$$

$$\Rightarrow \frac{26.6 - 13.80}{\sqrt{\frac{(0.1)^2}{25} + \frac{(0.5)^2}{25}}}$$

$$\Rightarrow \frac{12.80}{\sqrt{0.0004 + 0.01}}$$

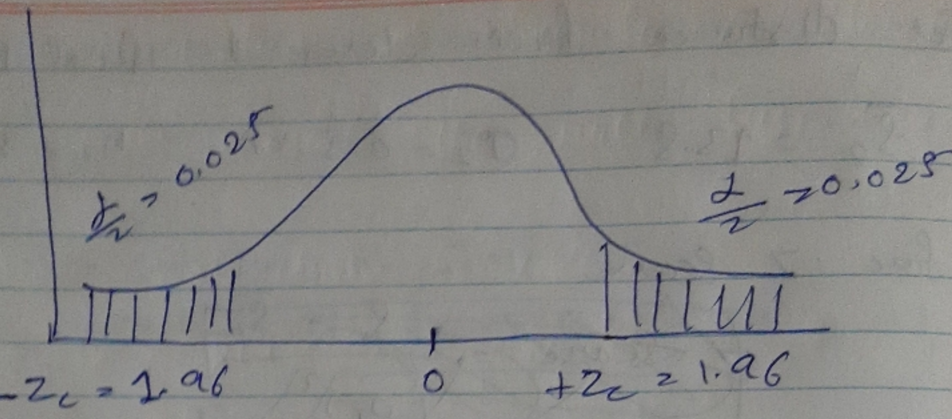
$$= \frac{12.8}{0.102}$$

$$\boxed{Z\text{-score} = 125.51}$$

using Z table

Z - critical $= 1.96$

P - value $= 0.0000$



Step 7: Testing Statistics

Using Decision Rule
for critical value,
if Z-critical < Z-Score
1.96 < 125.51

we reject null hypothesis

for critical value.
if P-value < significance value

0.0000 < 0.05

we reject null hypothesis

Step 8: By testing we say that

Distance from lens to object and distance from lens to real image are not same

$\mu_A \neq \mu_B$

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Date: (15)

Ans (5)

Step 1 Null and Alternate hypothesis

Null hypothesis :- Mean body temperature is 98.6

alternative hypothesis - mean body temperature is not equal to 98.6

$H_0 : \mu = 98.6$

$H_A : \mu \neq 98.6$

it is two tailed test as we test it on two ends.

$$\frac{\alpha}{2} = \frac{0.02}{2} = 0.01$$

Step 2 Determine the test

· Perform T - test

Step 3: Significance Value

$\alpha = 0.02$

Step 4: Establish decision rule for critical value

if critical value < t-score

we reject null hypothesis

for P-value < significance level we will reject the null hypothesis

Step 5 Data Collection

$s = 0.6824$

$\bar{x} = 98.2846$

$n = 52$

Step 6 Data analysis

$$T\text{-Score} = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$$

$n = 52$

$\bar{x} = 98.2846$

$s = 0.6824$

$DF = n - 1$

$= 52 - 1$

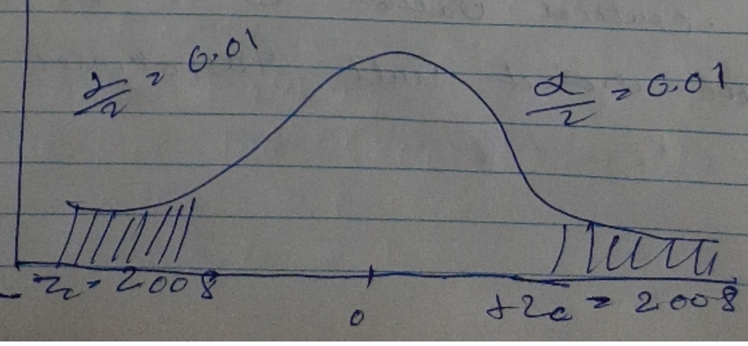
$\boxed{DF = 51}$

$$t\text{-Score} = \frac{98.2846 - 98.6}{\frac{0.6824}{\sqrt{52}}}$$

using t-table

t-critical = 2.008

P-value = 0.0016



Step 7 take Statistical Action.

Based on decision Rule
For critical value
ie.
t- critical < t - score
2.008 < 3.333

we reject null hypothesis

For P- value
ie P-value < Sigificance level

0.0016 < 0.02

we reject ~~to~~ null hypothesis
So, mean body temp is not equal
to 98.6°F.

Ans ⑥

Step 1: Null and Alternate hypothesis

Null hypothesis: ~~to~~ no difference between
premium and regular gas
in mileage

Alternate hypothesis: there is difference
between mileage a regular
and premium gas tank

$H_0 \Rightarrow \mu_A = \mu_B$

$H_A \rightarrow \mu_A \neq \mu_B$

it is a two tailed test as we check both
ends.

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Date (18)

Step 2: Determine the test
Perform t - test

Step 3: Set Significatione value
Significance value not given hence
As default

$$\boxed{\alpha = 0.05}$$

$$\alpha = \frac{0.05}{2} = 0.025$$

Step 4: Establish decision rule
for critical value
if t-critical < t-test
we reject null hypothesis
for P-value
if P-value < Significance value
we reject null hypothesis

Step 5: Data Collection
10 random chosen cars

Step 6 Data analysing
It is two sample variable

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$$Df = \frac{\left[\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right]^2}{\left[\frac{\left(\frac{S_1}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{S_2}{n_2}\right)^2}{n_2 - 1}\right]}$$

$$t\text{-test} = \frac{\overline{X_1} - \overline{X_2}}{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$$

for Regular tank

$\mu_R = \overline{X_1} = 23.1$

$n_1 = 10$

$S_1 = 3.72$

for Premium tank

$\overline{X_2} = 25.1$

$n_2 = 10$

$S_2 = 3.44$

$$Df = \frac{\left[\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right]^2}{\frac{\left(\frac{S_1}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{S_2}{n_2}\right)^2}{n_2 - 1}}$$

$$= \frac{(1.38 + 1.18)^2}{\left(\frac{1.38)^2}{9} + \frac{(1.18)^2}{9}}$$

$$\Rightarrow \frac{6.55}{\frac{1.90}{9} + \frac{1.39}{9}} = \frac{6.55}{0.36}$$

$$\boxed{DF = 18}$$

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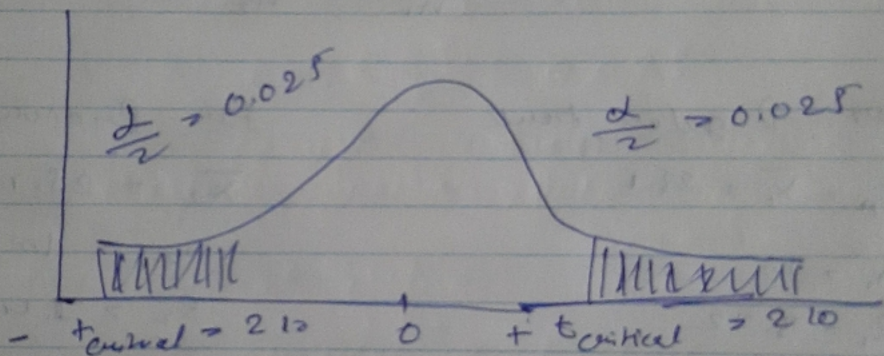
$$t\text{-test} = \frac{\bar{x}_1 - \bar{x}_2}{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$= \frac{23.4 - 25.1}{\frac{(3.72)^2}{10} + \frac{(3.44)^2}{10}}$$

$$\boxed{t\text{-test} = 1.24}$$



By using t-table,

t-critical = 2.10

P = 0.22

Step 7

using statistics

on basis of decision rule

for t critical,

if t-critical < t-score

we reject null hypothesis

t-critical > t-score

2.10 > 1.24

we accept null hypothesis

for P-value

if P-value > Significance value

$0.22 > 0.05$

we accept null hypothesis

So, we conclude as $\mu_A = \mu_B$

there is no difference in mileage between regular and premium tank

Ques (7)

Step 1 Establish Null and Alternate hypothesis

Null hypothesis - Sugar content of brand of cereal for child and adult are same

Alternate hypothesis - Sugar content of cereal for child and adult are not same

$H_0 \Rightarrow \mu_A = \mu_B$

$H_A \Rightarrow \mu_A \neq \mu_B$

it is a two tailed test as we check both ends.

Step 2 Perform t-test

Since we are comparing the t-test

Step 3 Significant value

At confidence level is 95%.

$\alpha = 5\%$

$\boxed{\alpha = 0.05}$

$\alpha = \frac{0.05}{2} = 0.025$

Step 4 Establish decision rule

For critical value

if t-critical < t-test

we reject Null hypothesis

For P-value

if P-critical < t-test

we reject Null H

if P-value < significance level

we reject null hypothesis

Step 5 Collections the data

Sugar content of several national brand of cereals, provided

Step 6 Data Analysis.

it is t-test for two sample variable

$$d_f = \frac{\left[\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right]^2}{\frac{\left(\frac{s_1}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2}{n_2}\right)^2}{n_2 - 1}}$$

$$t\text{-test} = \frac{\bar{x}_1 - \bar{x}_2}{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

For children

$\bar{x}_1 = \mu_A = 46.8$

$n_1 = 19$

$s_1 = 6.41$

For Adult

$\bar{x}_2 = \mu_B = 10.16$

$n_2 = 29$

$s_2 = 7.47$

$$D_f = \frac{\left[\frac{s_1^2}{n_1} + \frac{s_2^2}{n}\right]^2}{\frac{\left(\frac{s_1}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2}{n_2}\right)^2}{n_2 - 1}}$$

$$\Rightarrow \frac{2.16 + 1.92}{\frac{(2.16)^2}{18} + \frac{(1.92)^2}{28}} \Rightarrow \frac{16.64}{0.38}$$

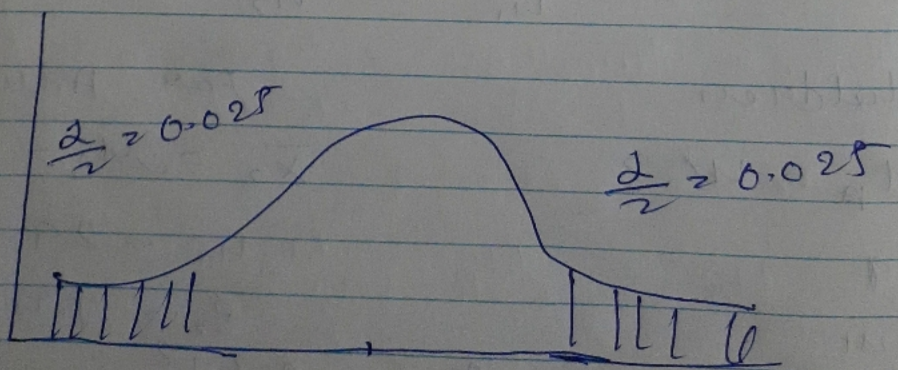
$$\boxed{Df \Rightarrow 43}$$

$$t\text{-test} = \frac{\bar{x}_1 - \bar{x}_2}{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$$

$$= \frac{6.41 - 7.47}{\sqrt{\frac{(6.41)^2}{19} + \frac{(7.47)^2}{29}}}$$

$$= \frac{36.38}{1.96} \Rightarrow$$

$$\boxed{t\text{-test} = 18.10}$$



$-t_c = -2.01$ $\quad$ $+t_c = 2.01$

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using t- table

$t_c = 2.01$

P - value = 0.0001

Step 7 On basis of decision rule

for critical value,

t- critical < t- test

2.01 < 18.10

we reject null hypothesis

for p- value,

p- value < significance value

0.0001 < 0.05

we reject null hypothesis

So sugar content of cereals for child and adult are not same or equal