Problem 1

Solution:-

⇒ Step 1 :- Establish Null & Alternate hypothesis

Null hypothesis = 5% of Nation children had autism.

Alternate hypothesis = More than 5% of nation children had autism.

i.e $H_0 : P = 0.05$

$H_A : P > 0.05$

Since P is greater so it will be one tailed test

Step 2 : Determine the test. We are going to perform the z-test.

Step 3 :- Set value of alpha (α)

$\alpha = 5\%$ $\alpha = 0.05$

Step 4 :- Establish the decision Rule.

For Z-critical, if

Z critical < Z-score (Test score)

we will reject null hypothesis

& for P-value,

P. < significance level

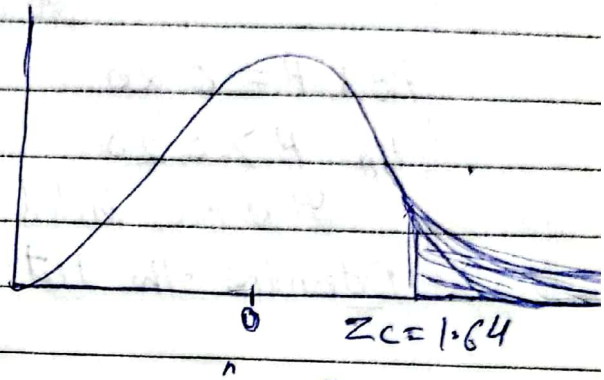
we reject Ours null hypo

Step5 : Gathering Data

In 384 children found out 46 showed signs of autism.

5% of the nation children had autism.

Step6: Analyze



$P = 0.05$

$n = 384$

$$\text{so } Z\text{ score} = \frac{\hat{P} - P}{\sqrt{\frac{P \times (1-P)}{n}}} = \frac{\hat{P} - P}{\sqrt{\frac{P \times q}{n}}}$$

$$\hat{P} = \frac{46}{384} = 0.119$$

$$q = (1-P) = 1 - 0.05 = 0.95$$

$$Z\text{score} = \frac{0.119 - 0.05}{\sqrt{\frac{0.05 \times 0.95}{384}}}$$

$$Z\text{score} = 5.39$$

Step7 Statistical decision

$Z_{critical} = 1.64$ & $Z_{score} = 5.39$.

so $Z_c < Z_{score}$

$1.64 < 5.39$ So we reject Null hypothesis

So. More than 5% of nation children had autism. Increase in certain content of chemical in environment had led to an increase in autism.

Problem 2.

Solution:- Step1 : Establish Null & Alternate Hypothesis

Null hypothesis :- 20% of the car failed to meet population guidelines.

Alternate hypothesis :- more than 20% of the failed to meet population guidelines.

$H_0 : P = 0.20$

$H_A : P > 0.20$

It is one tailed test.

Step2:- Determine the test :- we will perform Z-test

Step3 Set significance value,

$\alpha = 10\%$ i.e $\alpha = 0.10$

Step 4 Establish decision Rule.

for Z-critical

$Z_c <$ Z score then we will reject null hypoth

for P-value

Pvalue $<$ significance value we will reject null hypot.

Step5 Collecting Data

Company with fleet of 150 cars found that emission type system of 7 out of 22 cars tested failed to meet pollution guidelines.

Step 6 Analysis of Data

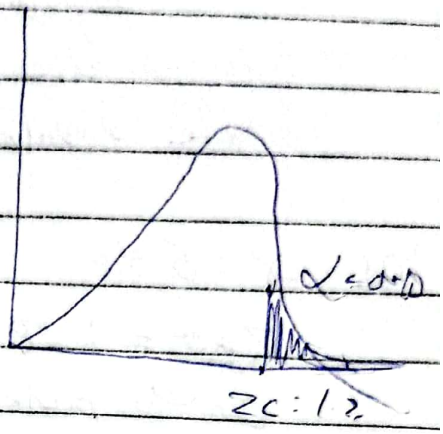
$$Z\text{-score} = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$$

$p = 0.20$, $n = 22$

$\hat{p} = \frac{7}{22} = 0.31, \quad q = 1 - p = 0.80.$

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

$$= \frac{0.11}{\sqrt{\frac{1.60}{22}}}$$



$Z_{score} = 1.29$

$Z_c = 1.3$

ϕ value $= 1.003$.

Step 7 Take statistical decision.

for Z-critical

$Z_c > Z_s$

$1.3 > 1.28$

so we will not reject the null hypothesis.

P-value

$P_v > \alpha$

$1.003 > 0.10$

we accept the null hypothesis.

So. 20% of the entire population fleet of the cars are failed to meet the population guideline.

Step8. Determine Buriness Implication.

Hence the 20% of the cars are failed to meet the population guideline that why we should impro the cars so that they can meet to the population guideline.

For $\alpha = 5\%$ $\alpha = 0.05$.

$Z_{score} = 1.28$ using Z-table $Z_c = 1.64$

On the basis of Decision Rule

$Z_c > Z_s$

$1.64 > 1.28$

so we accept the null hypothesis that 20% of the entire fleet of the cars are failed to meet the population guideline.

In this case the car manufactures should improve the cars effeciency that they can meet the population guideline

For $\alpha = 1\%$ $\alpha = 0.01$

$Z_{score} = 1.28$ $Z_{critical} = 2.33$.

so $Z_{critical} > Z_{score}$

$2.33 > 1.28$

we will accept the null hypothesis that. 20% of entire fleet of car are failed to meet the population guideline.

Problem 8

Solution Step1 : Establish Null & Alternate hypothesis

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

Alternate hypothesis :- more than 44% of the adult population had never smoked.

$H_0 : P = 0.44$

$H_a : P > 0.44$

It is a one-tailed test,

Step2: Determine the test

Perform the Z-test

Step3: Set the value of significance level

And Confidance level is 98% then

$\alpha = 2\%$

$\alpha = 0.20$

Step4: Establish the decision Rule

Zcritical < Z test we reject null hypothesis

P value < significance value we reject null hypothesis

Step5: Gathering data

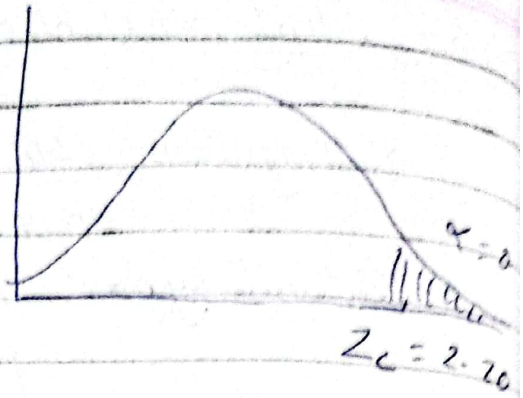
Random sample of 891 adults were interviewed and 463 stated that they had never smoked.

Step6: $Z \text{ score} = \frac{\hat{P} - P}{\sqrt{\frac{P \times (1-P)}{n}}} = \frac{\hat{P} - P}{\sqrt{\frac{P \cdot Q}{n}}}$

as $P = 0.44, n = 891$ $\quad \hat{P} = \frac{463}{891} = 0.519$

$\therefore \frac{0.519 - 0.44}{\sqrt{\frac{0.44 \times 0.56}{891}}} = 4.75$

Z score = 4.75



By using Z table

Zc = 2.20

Step 7: Statistical action

Zscore = 4.75 Zcritical = 2.20

so as per the decision Rule,

Zc < Zscore

2.20 < 4.75

we reject the null hypothesis hence the more than 44% of the adult population had never smoked

Step 8:

So more than 44% of the adult population never smoked.

Problem

Solution :- Step1 : Establish Null & Alternate hypothesis.

Null hypothesis : The distance from the lens to the object and distance from the lens to the real image is same.

Alternate hypothesis : The distance from the lens to the object and distance from the lens to real image is not same.

$H_0 : \mu_A = \mu_B$

$H_A : \mu_A \neq \mu_B$

Step2 :- Perform Z test.

Step3 :- Significance level $\alpha = 0.05$

It is a 2 tailed test therefore

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

Step4 :- Establish the Decision Rule

For critical value

Z critical < Z score we reject the null hypoth

Step5 :- Collecting the data.

Distance s_1 & s_2 are measured independently 25 times.

Sample mean $\bar{s}_1 = 26.6$ cm $\quad \bar{s}_2 = 138$ cm.

and standard deviation of the measurement is 0.1 cm from s_1 & 0.5 cm from s_2

Step 6: Analysis of the data. 2 Sample Z-Test

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

For Distance from the lens to object S_1

$\overline{S_1} = 26.6\,cm$

$S_1 = 0.1\,cm$

$n_1 = 25$

& For distance from lens to Real image S_2

$\overline{S_2} = 13.8$

$S_2 = 0.5\,cm$

$n_2 = 25$

For Z-score

$$Z\text{-score} = \frac{\overline{S_1} - \overline{S_2}}{\sqrt{\frac{(S_1)^2 + (S_2)^2}{n_1 + n_2}}}$$

$$= \frac{26.6 - 13.8}{\sqrt{\frac{(0.1)^2}{25} - \frac{(0.5)^2}{25}}}$$

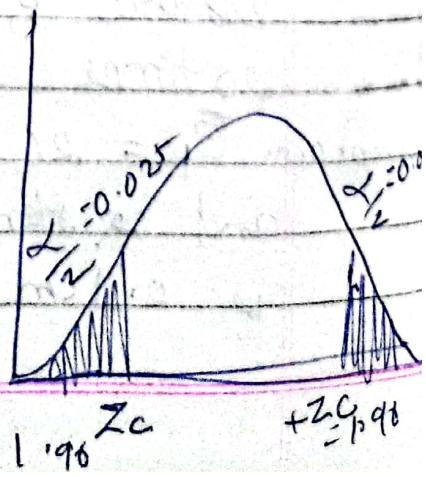
$$= \frac{12.8}{0.102}$$

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

Now using Z-table

Zcritical = 1.96

P-value = 0.00



Ans 7 :- Statistical Action

On the base of Decision Rule

Z critical < Z score

1.96 < 125.51 we reject null hypothesis

For critical value,

if p-value < significance value

0.00 < 0.05 we reject null hypothesis

Hence the distance from the lens to the object and distance from the lens to the real image are not same.

ie. $\mu_A \neq \mu_B$

Problem 5

Solution: Step1

Null hypothesis: Mean Body temparature is 98.6

Alternate hypothesis: Mean Body temparature is not equal to 98.6

$H_0 : \mu = 98.6$

$H_0 : \mu \neq 98.6$

It is 2 tailed test.

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

Step2 we will perform t test.

Step3 $\alpha = 0.02$

Step4: Decision Rule.

if $t_{critical} < t_{score}$ we reject null hypothesis

For p-value.

p-value < significance level we reject null hypothesis

Step5: Collecting the data

Body temparature in degrees Fahrenheit of 52 randomly chosen healthy adults is measured with the following

$n = 52$, $\bar{x} = 98.2846$

$s = 0.6824$

Step 6: Analysis of data.

As we are testing only one random variable and its standard deviation is given

$$t\text{-score} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

where $n = 52$

$\bar{x} = 98.2841$

$s = 0.6824$

$\mu = 98.6$

$DF = n - 1$

$= 51$

$$= \frac{98.2841 - 98.6}{\frac{0.6824}{\sqrt{52}}}$$

t score $= 3.33$

Since it is 2 tailed test

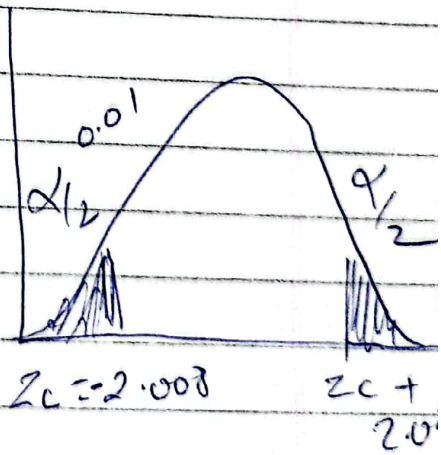
$$\alpha = \frac{\alpha}{2} = \frac{0.02}{2}$$

$\alpha = 0.01$ & $DF = 51$

Now using t-table.

t-critical $= 2.008$

P-value $= 0.0016$



Step 7 Take statistical action.

t critical < t score

$2.008 < 3.33$.

We reject null hypothesis

For P-values,

If

P-value < significance level

0.0016 < 0.02

we reject null hypothesis

So,

the mean body temp is not equal to 98.6°F.