Hypothesis testing assignment

7) a) H_0: Differences are ~~not~~ due to chance and neither distributor is ~~not~~ giving less.

b)

O_i	E_i	$\frac{\sum(O_i-E_i)}{E_i}$
70	72	4
69	72	9
73	72	1
68	72	16
71	72	1
69	72	9
71	72	1

$\chi^2_6 = 41/72 = 0.569$

At 5% CI, $\chi^2_6 = 12.59$. Now as $0.569 < 12.59$ we will accept H_0 & conclude that differences do not occur by chance or purposely.

Null hypothesis will not be rejected at ~~any~~ mentioned confidence level.

8) $\mu = 145$, ~~σ~~ $\sigma = 100$, $\bar{x} = 147$, $n = 144$

~~He takes a random sample,~~

~~H_0: Plotting technique~~

H_0: $\mu = 145$

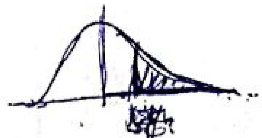
H_1: $\mu > 145$ is significant increase in pods

$\bar{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right)$

6) Test statistic $Z = \dfrac{\bar{X} - \mu}{\sigma/\sqrt{n}}$

$$= \frac{147 - 145}{100/\sqrt{144}}$$

$$\approx 0.24$$



1.96

At 5% CI, z from table = 1.645

As $0.24 < 1.645$, we accept H_0 and conclude that mean no. of pods is 145 and not increasing ~~stat~~ significantly

7) $\bar{X} = 147$, $\mu = 145$, $\sigma = 20$, $n = 200$

$H_0 : \mu = 145$

$H_1 : \mu > 145$

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} = \frac{147 - 145}{20/\sqrt{200}}$$

$$= 1.414$$

At 5% CI, p-value = 1.645. As $1.414 < 1.645$, we accept H_0 and conclude that mean height is 145 for 7th graders over the years.

5) $H_0 = \frac{1}{4} \times 100 = 25$ ie, all candidates are equally likely

O_i	E_i	$\sum \frac{(O-E)^2}{E}$
41	25	256/25
19	25	36/25
24	25	1/25
16	25	81/25

$\sum \frac{(O_i - E_i)^2}{E} = 14.96$ is test statistic χ^2_3

At 5% CI, $\chi^2_3 = $ 7.815, As $14.96 > 7.815$, we reject H_0 and conclude that customers preference for all candidates are not equally likely.

3) $\mu = 34$, $\sigma = 8$, $n = 50$, $\bar{x} = 32.5$.

H_0: average fluid discharged is unchanged

H_1: average fluid discharged is lowered.

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{32.5 - 34}{8/\sqrt{50}}$$

$$= -1.326$$

At 1% level of significance, $Z = -2.3263$.

As $-2.3263 < -1.326$, we accept H_0 and conclude that average discharged liquids hasn't changed.

2) $H_0: \mu_0 = 52$

$H_1: \mu_0 > 52$

$\mu = 52$, $\sigma = 4.5$, $n = 100$, $\bar{x} = 52.80$

$$Z = \frac{52.80 - 52}{4.5/\sqrt{100}}$$

$$= 1.78$$

Scanned with CamScanner

At 5% CI, ~~p~~ value = 1.6449

As 1.6449 < 1.78, we reject H_0 and conclude that average cost is higher

1)a) H_0: $\mu_0 = 2.75$

H_1: $\mu_1 \neq 2.75$

$n = 256$, $\mu = 2.75$, $\bar{X} = 2.85$, $sd = 0.65$

b) standard error $= \frac{sd}{\sqrt{n}} = \frac{0.65}{\sqrt{256}}$

$= 0.0406$

c) As it is a 2 tailed test, we will take ± ~~t~~ value of 2.5% CI.

~~t value from table~~ = ~~± 0.6745~~ ± 1.96

z value at 2.5% level = ±1.96

d) ~~$Z = \frac{\bar{X} - \mu}{s/\sqrt{n}}$~~

with large value of n = 256, t distribution follows standard normal distribution as n tends to ∞. Hence

$$\bar{X} \sim N\left(\mu, \frac{sd^2}{n}\right)$$

d) $$Z = \frac{\bar{X} - \mu}{sd/\sqrt{n}} = \frac{2.85 - 2.75}{0.65/\sqrt{256}}$$

$= 2.462$

As 2.462 > 1.96, it falls under the critical region

Scanned with CamScanner

Hence we reject H_0 and conclude that average GPA has changed from 2.75 from last year.

4) $H_0: p_1 - p_2 \leq 0.10$

$H_1: P_1 - P_2 > 0.10$

Given

$\hat{p}_1 = 0.53$

$\hat{p}_2 = 0.20$

$$Z = \frac{(\hat{p}_1 - \hat{p}_2) - D}{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}}$$

$$\cancel{\hat{p} = \frac{X_1 + X_2}{n_1 + n_2} = \frac{180 + 140}{300 + 700} = 0.26}$$

$$\cancel{= \frac{(0.53 - 0.20) - 0.10}{\sqrt{\frac{0.26 \times 0.74}{300} + \frac{0.26 \times 0.74}{700}}}}$$

$$= \frac{(0.53 - 0.20) - 0.10}{\sqrt{\left(\frac{0.53 \times 0.47}{300} + \frac{0.20 \times 0.80}{700}\right)}}$$

$$= \frac{0.23}{0.0325}$$

$$= 7.068$$

Critical point $Z_{5\%} = 1.6449$

As $1.6449 > 7.068$, we reject H_0 and conclude that difference in population proportion is greater than 10% when sweepstakes are on

5) $N = 15$, $col = 3$, $N - c = 12$

H_0: Three sample means were obtained from the sample population.

H_1: At least one sample mean is not statistically significant

Grand mean $\bar{\bar{X}} = \frac{400 + 425 + 375}{3 \times 5}$

$= 80$

$SSTR = \sum r_j (\bar{X}_j - \bar{\bar{X}})^2$

$= [5 \times (80 - 80)^2 + 5 \times (85 - 80)^2 + 5(75 - 80)^2]$

$= 250$

$MSTR = \frac{SSTR}{c-1} = \frac{250}{2} = 125$

$SSE = \sum\sum (x_{ij} - \bar{x}_j)^2$

A_1	A_2	A_3	$(A_1 - A_{1mean})^2$	$(A_2 - A_{2mean})^2$	$(A_3 - A_{3mean})^2$
86	90	82	36	25	49
79	76	68	1	81	49
81	88	73	1	9	4
70	82	71	100	49	16
84	89	81	16	16	36
Mean 80	85	75	Total 154	Total 180	Total 154

$SSE = 488$

$$MSE = \frac{SSE}{n-c} = \frac{488}{12} = 40.67$$

$$F_{2,12} = \frac{MSTR}{MSE} = \frac{125}{40.67} = 3.07$$

critical value of $f_{2,12}$ @ 5% CI = 3.885

As $F_{2,12} < F_{2,12}$ critical value (is $3.07 < 3.885$)

we accept null hypothesis and conclude that 3 sample means ~~are the~~ were obtained from sample population are equal.