Hypothesis testing assignment

7) a) H_0: Differences are not due to chance and neither distributor is 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) $\mu = 145$, $\sigma = 100$, $\bar{X} = 147$, $n = 144$

~~He takes a random sample,~~

~~H_0: Planting technique~~

H_0: $\mu = 145$

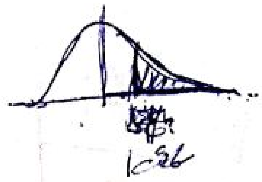
H_1: $\mu > 145$ is significant increase in pods

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

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

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

$$\approx 0.24$$



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_3^2

At 5% CS, $\chi_3^2 = 7.815$, 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: $\mu_0 > 52$

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

$$Z = \frac{52.80 - 52}{4.5/\sqrt{100}}$$
$$= 1.78$$

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 $\pm$ ~~t~~ value of 2.5% CI.

~~t value from table~~ = ± 1.96

z value at 2.5% level $= \pm 1.96$

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

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

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

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

$H_1 : p_1 - p_2 > 0.10$

<u>Given</u>

$\hat{p}_1 = 0.53$

$\hat{p}_2 = 0.20$

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

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

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

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

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

$$= 7.068$$

Critical point $Z_{5\%} = \cancel{2.3263}\ 1.6449$

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