# MSIT 431: PROBABILITY AND STATISTICAL METHODS

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**Ques 1. Textbook Exercise 7.81**

**Solution 1.** (a) n1=60

$Mean_1$=53

s1=12

n2=58

$Mean_2$ =50

s2=10

confidence interval=95%

t*=2.009

Hence, interval $\mu_1 - \mu_2 = (\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{S_1{}^2}{n_1} + \frac{S_2{}^2}{n_2}} = 3 \pm 2 * \sqrt{\frac{144}{60} + \frac{100}{58}}$

$=3 \pm 4.0616$ = (-1.0616, 7.0616)

(b) The mean change in sales in between interval (-1.0616, 7.0616)
Since it could zero or negative, it is possible that the sales might have decreased.

**Ques 2. Textbook Exercise 7.126**

**Solution 2.**

(a) n1=10, $mean_1$=49.7, s1=2.193
n2=10, $mean_2$=50.545, s2=1.826.

The two-sample t statistic t

$= \frac{\text{mean}_1 - \text{mean}_2}{\sqrt{\frac{S_1{}^2}{n_1} + \frac{S_2{}^2}{n_2}}} = \frac{-0.845}{0.9024}$=-0.9364

Degree of freedom=2(n-1)=18

P value is approximately 0.20

b) Mean Diff= -0.845

Standard diff = 1.275

t= $\frac{Mean\ diff}{\frac{\text{Standard diff}}{\sqrt{n}}}$

t = -0.845/0.403 = -2.13

df = n-1 = 9

p value ~ 0.025

c) the confidence interval is higher when we work with the differences, going from 60% to 95%

**Ques 3. Textbook Exercise 7.128**

**Solution 3.** $(a)$ $H_0 : \mu_1 - \mu_2$=0

$H_a : \mu_1 - \mu_2 \neq$0
n1=308, $\bar{x}_1$=158.03, s1=33.8; n2=317, $\bar{x}_2$=189.49, s2=41.3.
df=307
The two-sample t statistic t= $\frac{\bar{x}_1-\bar{x}_2}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$ =$\frac{-31.46}{3.015}$=-10.435

p value less than 0.0001

Since p value is less than 0.05, so the null hypothesis is rejected at 5% level of significance.

(b) Confidence level =95%

$(\bar{x}_1 - \bar{x}_{2)} \pm t * \sqrt{\frac{\text{S1}^2}{\text{n1}} + \frac{\text{S2}^2}{\text{n2}}}$

(158.03 – 189.49) $\pm$ 1.984 * $\sqrt{\frac{33.8^2}{308} + \frac{41.3^2}{317}}$

(-37.4417, -25.4783)

(b) These intervals cannot be applied to two individuals. It is based on a much larger sample.

**Ques 4. Textbook Exercise 8.29**

**Solution 4.**(a)

Confidence interval=95%,
z*=1.96
n=40
p=0.4.
$H_0$ : $\hat{p}$=0.4
$H_a$ : $\hat{p}$ ≠0.4

Confidence interval =0.4±1.96* $\sqrt{\frac{0.4(1-0.4)}{40}}$

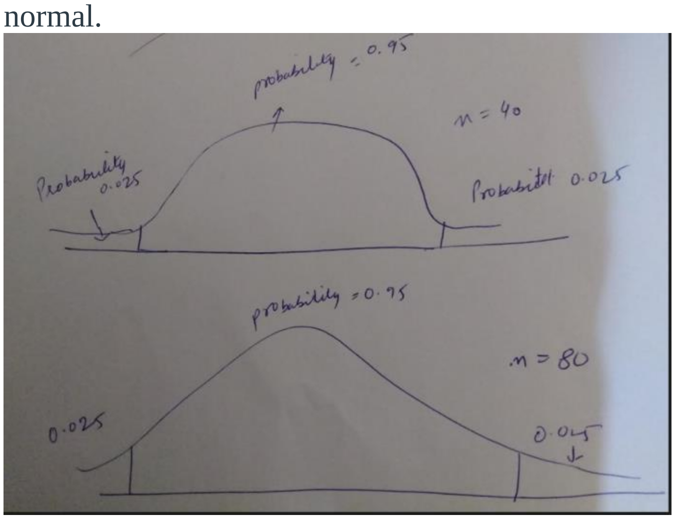
=0.4±0.1556=(0.2444, 0.5556)

(b) Confidence level=95%
z*=1.96,
n=80,
$H_0$ : $\hat{p}$=0.4
$H_a$ : $\hat{p}$ ≠0.4

Confidence interval =0.4±1.96* $\sqrt{\frac{0.4(1-0.4)}{80}}$

=0.4±0.11=(0.2899, 0.5100)

(c) As n increases, margin of error decreases, thereby making the distribution approximately normal.




**Ques 5. Textbook Exercise 8.36**

**Solution 5.**

a) n = 30 p = 0.3

n*p = 30 * 0.3 = 9

n*(1-p) = 21

Should not use normal approximation as the value of n*p is less than 10.

b) n*p = 12
  n*(1-p) = 48
We can use normal approximation as the values of n*p and n*(1-p) are greater than 10.

c) n*p = 12

   n*(1-p) = 88

We can use normal approximation as the values of n*p and n*(1-p) are greater than 10.

d)  n*p = 6

   n*(1-p) = 144

Should not use normal approximation as the value of n*p is less than 10.

**Ques 6. Textbook Exercise 8.40**

m≤0.25

$m = z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$0.25 \geq 1.96^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$0.25 \geq 1.96^2 * \frac{\hat{p}(1-\hat{p})}{n}$

$n \geq 16 * 1.96^2 * \hat{p}(1-\hat{p})$

$\hat{p}(1-\hat{p})$ = 0.5*0.5=0.25.

n≥15.3664 ~ 16