# ASSIGNMENT : 03

## Course : Computational Statistics And Probability

**Submitted By,**

Group A

**Section : K**

Date of Submission : 19th July, 2021

**Name : HIMI, HUMAYRA**

**ID : 17-34572-2**

Subject : Date :

Q.1 12 20 5 25 10 35
1 2 3 4 5 6

(1) mean of the pharmacis $= 107/6 = 17.83$

(2) Total $= N\bar{x} = \cancel{28 \times 19 = 532}$
$28 \times 17.83 = 499.24$

(3) $s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \left(\frac{(\Sigma x)^2}{n}\right)\right]$

$= \frac{1}{5}\left(2519 - \frac{107^2}{6}\right)$

$= \frac{1}{5}(2519 - 1908.16)$

$= 122.168$

$v(\bar{x}) = \frac{28-6}{28 \times 6} \times 122.168 = 15.99$

The standard error of estimate mean is

$se(\bar{x})\sqrt{v(\bar{x})} = \sqrt{15.99} = 3.99$

(4) $v(\hat{X}) = N^2\{v(\bar{x})\} = 28^2 \times 15.99$
$= 12538.16$

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Subject : Date :

(7) The proportion of regions in which there are less than 18 pharmacies is $\Rightarrow$

$$p = \frac{a}{n} = \frac{1}{6} = 0.17$$

So, a is the number of region in which there are less than 18 pharmacies

9.1 Let $x \sim N(4, \sigma^2)$, $\sigma^2$ is unkown
We need to test $H_0: \mu = \mu_0 = 5$ vs $H_1: \mu \neq \mu_0$

$$\bar{x} = \frac{1}{n} \Sigma x = \frac{72}{10} = 7.2, \quad s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]$$

$$= \frac{1}{9}\left(758 - \frac{72^2}{10}\right) = 26.62$$

Test statistics $t: \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{7.2-5}{5.16/\sqrt{10}} = 1.35$

Since, $|t| < t_9 = 2.262$. So, $H_0$ is accepted

Hence we can conclude that the average schooling years can be considered as 5

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Subject : Date :

9.5/

$\bar{x} = \frac{761.6}{36} = 21.16$

$s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right] = \frac{1}{35}\left(16125.5 - \frac{716.6^2}{36}\right)$

$= 0.384$

$z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{21.16 - 21}{\frac{0.6197}{\sqrt{36}}} = 1.55$

$\therefore |z| < 1.96$ so, $H_0$ is accepted.

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18-39062-3

Problem 8.1

Here $N = 28$ , $n = 6$

Colum 1 from the table. Last serial number of 2 digit.
So, we will select random number of two digits

| Random number | 11 | 16 | 9 | 12 | 18 | 10 |
|---|---|---|---|---|---|---|
| Pharmacies region | 20 | 25 | 20 | 18 | 18 | 13 |

1) Estimate of mean, $\bar{x} = \frac{1}{n} \Sigma x = \frac{114}{6} = 19$ (m)

2) Estimate total, $\hat{x} = N\bar{x} = 28 \times 19 = 532$ (L)

3) We know $s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]$

$= \frac{1}{5} \; 2242 - \left(\frac{114}{6}\right)^2$

$= \frac{1}{5}(76)$

$= \cancel{18}\, 15.2$

$$v(\bar{x}) = \frac{N-n}{Nn} s^2$$

$$= \frac{26-6}{28\times 6} \times 15.2$$

$$= 1.99$$

The standard error of estimated of mean is

$$s.e(\bar{x}) = \sqrt{v(\bar{x})} = \sqrt{1.99}$$
$$= 1.41 \ (m)$$

4) Estimate standard error $= N^2 [v(\bar{x})]$
$$= 28^2 \times 15.2$$
$$= 11916.8 \ (m)$$

7. Estimate of proportion of region in which there are less than than pharmacies are given $p = \frac{a}{n} = \frac{1}{6}$

$$= 0.17$$

Here $a$ - Number of region where pharmacies are less ~~tan~~ than 18 - 1

Ans to the Q no- 9.1

Let $x \sim N(\mu, \sigma^2)$, $\sigma^2$ is unknown

$\therefore H_0 : \mu_0 = 5$ vs $H_1 = \mu \neq \mu_0$

$\bar{x} = \frac{1}{n} \Sigma x = \frac{72}{10} = 7.2$, $S^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]$

$= \frac{1}{9}\left(755 - \frac{72^2}{10}\right)$

$= 26.62$

$\therefore t = \frac{\bar{x} - \mu_0}{S/\sqrt{n}} = \frac{7.2 - 5}{\frac{5.16}{\sqrt{10}}} = 1.35$

Here $|t| < t_g = 2.262$ So $H_0$ is accepted

So, average schooling year can be considered as

Problem - 9.5

$$\bar{x} = \frac{261.6}{36}$$

$$= 21.16$$

$$S^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x^2)}{n}\right]$$

$$= \frac{1}{35}\left(16125.5 - \frac{(216.6)^2}{36}\right)$$

$$= 0.384$$

$$Z = \frac{\bar{x} - \mu_0}{S/\sqrt{n}} = \frac{21.16 - 21}{\cancel{0.6197} / \sqrt{36}}$$

$$= 1.55$$

$\therefore |Z| < 1.96$ $\boxed{\text{Accepted}}$

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## 8.1

Here $N = 28$

$n = 6$ using number table

let us use column 1 from the table. The last serial number is two digit, so we need to select a random number of two digits

| random numbers | 2 | 9 | 6 | 12 | 15 | 17 |
|---|---|---|---|---|---|---|
| Pharmacies of selected regions | 20 | 25 | 35 | 18 | 24 | 15 |

i) Estimate of mean, $\bar{x} = \frac{1}{n} \sum x = \frac{137}{6} = 22.83$

ii) Estimate total, $\hat{x} = N\bar{x} = 28 \times 22.833 = 639.33$

iii) We know $s^2 = \frac{1}{n-1} \left[ \sum x^2 - \frac{(\sum x)^2}{n} \right]$

$= \frac{1}{5} \left( 3375 - \frac{137^2}{6} \right)$

$= \frac{1}{5} (3375 - 3128.16)$

$= 49.36$

$$V(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28\times 6} \times 49.36 = 6.463$$

The standard error of estimate of mean is

$$s.e.(\bar{x}) \sqrt{V(\bar{x})} = \sqrt{6.463} = 2.542$$

iv) The estimate of standard error of estimate of population $V(\hat{X}) = N^2\{V(\bar{x})\} = 28^2 \times 6.463$

$= 5067.626$

vi) The estimate of proportion of regions in which there are less than 18 pharmacies are given by $p = \frac{a}{n} = \frac{1}{6} = 0.17$

Here $a =$ number of regions in the sample there are less than 18 pharmacies $= 1$

## 9.1

Let $x \sim N(\mu, \sigma^2)$, $\sigma^2$ is unknown

We need to test, $H_0 : \mu = \mu_0 = 5$ vs $H_1 : \mu \neq \mu_0$

$$\bar{x} = \frac{1}{n} \sum x = \frac{72}{10} = 7.2$$

$$s^2 = \frac{1}{n-1} \left| \sum x^2 - \frac{(\sum x)^2}{n} \right| = \frac{1}{9}\left(758 - \frac{72^2}{10}\right) = 26.62$$

Test statistic : $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{7.2 - 5}{5.16/\sqrt{10}} = 1.35$

Since $|t| < t_9 = 2.262$, so $H_0$ is accepted.

Hence we can, conclude that the average schooling years can be considered as 5.

## 9.5

$$\bar{x} = \frac{761.6}{36} = 21.16$$

$$s^2 = \frac{1}{n-1} \left[ \sum x^2 - \frac{(\sum x)^2}{n} \right] = \frac{1}{36}\left(16125.5 - \frac{716.6^2}{36}\right)$$

$$= 0.384$$

$$z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{21.16 - 21}{0.6197/\sqrt{36}} = 1.5491$$

$\therefore$ $|z| < 1.96$ so, $H_0$, is accepted

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P: 1

8.1. $N = 28$

$n = 6$ using random number table.

let us use column 1 from the table.

The last serial number is of two digits.

so we need to select a random number of two digits. (from random number table)

| Random Numbers | 11 | 16 | 12 | 19 | 10 | 17 |
|---|---|---|---|---|---|---|
| Pharmacies of selected regions | 20 | 25 | 18 | 18 | 13 | 15 |

1. Estimate of mean, $\bar{x} = \frac{109}{6} = 18.17$

2. Estimate the total, $\hat{X} = N\bar{x} = 28 \times 18.17$

$= 508.76$

3. $s^2 = \frac{1}{5}\left(2067 - \frac{109^2}{6}\right)$

$= 17.37$

$v(\bar{x}) = \frac{28-6}{28 \times 6} \times 17.37 = 2.27$

The standard error of estimate of mean is, $s.e(\bar{X}) = \sqrt{V(\bar{x})} = \sqrt{2.27} = 1.50$

(Ans.)

4. The estimate of standard error of estimate of population, $V(\hat{X}) = N^2(V(\bar{x}))$

$$= 28^2 \times 2.27$$
$$= 1779.68$$

(Ans.)

9.1 We need to test, $H_0: \mu = \mu_0 = 5$ Vs

$H_1: \mu \neq \mu_1$

$\bar{X} = \frac{1}{n} \Sigma x = \frac{72}{10} = 7.2$, $s^2 = \frac{1}{9}\left(758 - \frac{72^2}{10}\right)$

$= 26.62$

$t = \frac{7.2 - 5}{5.16/\sqrt{10}} = 1.35$. Since $|t| < t_9 = 2.262$

So, $H_0$ is accepted.

9.5 we need to test $H_0: \mu = \mu_0 = 21$ vs

$H_1: \mu \neq \mu_0$

$\bar{x} = \frac{761.6}{36} = 21.15$, $s^2 = \frac{1}{35}\left(16125.5 - \frac{761.6^2}{36}\right)$

$= 0.383$

$z = \frac{21.15 - 21}{0.619/\sqrt{36}} = 1.45$.

Since $|z| < 1.96$. so $H_0$ is accepted.

(Ans.)

**Name : RONY, MD. ATIQUR RAHMAN**
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# Assignment - 3

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Problem: 8.1

Here,

$N = 28$

$n = 6$ [using random number table]

Using call column 1 from the table. The last serial number of two digit, so we need to select a random number of two digits.

| Random numbers | 11 | 16 | 9 | 12 | 19 | 10 |
|---|---|---|---|---|---|---|
| Pharmacies of selected regions | 20 | 25 | 20 | 18 | 18 | 13 |

1. Estimate of mean, $\bar{x} = \frac{1}{n} \Sigma x = \frac{114}{6} = 19.$ Ans

2. Estimate total, $\hat{x} = N\bar{x} = 28 \times 19 = 532$ Ans

3. We know, $s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]$

$$= \frac{1}{5}\left[2242 - \frac{(114)^2}{6}\right]$$

$$= \frac{1}{5}(76)$$

$$= 15.2.$$

$$V(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28\times 6} \times 15.2 = 1.9905$$

The standard error of estimated of mean is,

$$s.e.(\bar{x}) \sqrt{V(\bar{x})} = \sqrt{1.9905} = 1.411$$ Ans

4. The estimate of standard error of estimate of population $V(\hat{X}) = N^2 [V(\bar{x})]$

$$= 28^2 \times 15.2$$

$$= 11916.8$$ Ans

7. The estimate of ~~population~~ proportion of region in which there are less than 18 ~~parameters~~ pharmacies are given by $p = \frac{a}{n} = \frac{1}{6} = 0.17$

Here,

$a$ = Number of region in the sample in which there are less than 18 pharmacies $=1$

Problem: 9.1/ Let,

$x \sim N(\mu, \sigma^2)$, $\sigma^2$ is unknown.

we need to test, $H_0: \mu_0 = 5$ vs $H_1: \mu \neq \mu_0$

$$\bar{x} = \frac{1}{n} \sum x \frac{72}{10} = 7.2 \quad s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$$

$$= \frac{1}{9}\left(758 - \frac{72^2}{10}\right)$$

$$= 26.62$$

Test statistic : $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{7.2 - 5}{\frac{5.16}{\sqrt{10}}} = 1.35$

Since $|t| < t_9 = 2.262$, so $H_0$ is accepted.

We can conclude that the average schooling years can be considered as 5.

Problem : Q·5

$\bar{x} = \frac{761.6}{36} = 21.16$

$s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right] = \frac{1}{35}\left(16125.5 - \frac{716.6^2}{36}\right)$

$= 0.384$

$z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{21.16 - 21}{\frac{0.6197}{\sqrt{36}}} = 1.55$

$\therefore |z| < 1.96$ so, $H_0$ accepted.

**Name : FARABI, ISHTIAQ HOQUE**

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8.1 Here, $N = 28$

$n = 6$ using number table

let us use column I from the table The serial number is two digit so we need to select a random number of two digits

| random number | 2 | 9 | 6 | 12 | 15 | 17 |
|---|---|---|---|---|---|---|
| Pharmacies of select regions | 20 | 25 | 36 | 18 | 29 | 15 |

i) Estimate of mean $\bar{x} = \frac{1}{n}\sum x = \frac{137}{6} = 22.83$

ii) Estimate total $\hat{x} = N\bar{x} = 28 \times 22.833 = 639.33$

iii) We know $s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$

$= \frac{1}{5}\left(3375 - \frac{137^2}{6}\right)$

$= 49.36$

$$v(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28 \times 6} \times 49.36 = 6.463$$

The standard error of estimate of mean is

$$s.e.(\bar{x}) \sqrt{v(\bar{x})} = \sqrt{6.463} = 2.542$$

~~(iv)~~ 9.1 Let $x \sim N(\mu, \sigma^2)$ $\sigma^2$ is unknown

We need to test $H: \mu = \mu_0 = 5$ vs $H_1: \mu \neq \mu_0$

$$\bar{x} = \frac{1}{n} \sum x = \frac{72}{10} = 7.2$$

$$s^2 = \frac{1}{n-1} \left( \sum x^2 - \frac{(\sum x)^2}{n} \right) = \frac{1}{9}\left(758 - \frac{72^2}{10}\right) = 26.62$$

~~This~~ Test : $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = 1.35$

Since $|t| < t_{9} = 2.262$, So $H_0$ is accepted. Hence we can conclude that the ~~ag~~ average schooling years can be considered as s.

$$\bar{x} = \frac{\Sigma x}{n} = \frac{7616}{336} = 21.16$$

$$s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \left(\frac{(\Sigma x)^2}{n}\right)\right] = \frac{1}{36}\left(16125.5 - \frac{7616^2}{36}\right)$$

$$= 0.384$$

$$Z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = 1.5991$$

$\therefore |Z| < 1.96$ so $H_0$ is accepted.

**Name : JANNAT, JANNATUIL FERDOUSE**

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P-1

Jannatuil Ferdouse Jannat
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(a)

| | | | | | | |
|---|---|---|---|---|---|---|
| Random Numbers | 11 | 16 | 9 | 12 | 19 | 10 |
| Pharmacies of selected Regions | 20 | 25 | 20 | 18 | 18 | 13 |

(1) Mean no of selected pharmacies regions $(20+25+20+18+18+13)/6$

$= 114/6 = 19$

(2) Estimate total $= N\bar{x} = 28 \times 19$
$= 532$

$s.e(\bar{x}) = \sqrt{v(\bar{x})} = \sqrt{1.990}$
$= 1.410$

The variance of sample mean is $v(\bar{x}) = \frac{N-n}{Nn} s^2$

$= \frac{28-6}{28 \times 6} \times 15.2$

$= 1.990$

$s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right] =$

$= \frac{1}{6-1}\left(2242 - \frac{114^2}{6}\right) = 15.2$

(6) $V(x^n) = N^2 V(\bar{x}) = 28^2 \times 1.990$

$= 1560.16$

$s.e(\bar{x}) = \sqrt{V(\bar{x})} = \sqrt{1560.16}$

$= 39.49$

(7) No. are less than $B = 16, 13, 5$

$P = \frac{a}{n} = \frac{3}{6} = 0.5$

Hypothesis testing method

9.1 Let ~~x~~ $x \sim N(\mu, \sigma^2)$, $\sigma^2$ is unknown,

$H_0: \mu_0 = 5$ vs $H_1: \mu \neq \mu_0$

$\bar{x} = \frac{1}{n} \sum x = \frac{72}{10} = 7.2$ $s^2 = \frac{1}{n-1} \left[ \sum x^2 - \frac{(\sum x)^2}{n} \right]$

$= \frac{1}{9} \left(758 - \frac{72^2}{10}\right)$

$= 26.62$

Test statistic : $t = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}}$

$= \dfrac{7.2 - 5}{\frac{5.16}{\sqrt{10}}} \approx 1.35$

since $|t| < t_g = 2.262$. so $H_0$ is accepted. We can conclude that the average schooling years can be cosider as 5.

Q-5 $\bar{x} = \dfrac{761.6}{36} = 21.16$

$s^2 = \dfrac{1}{n-1}\left[\sum x^2 - \dfrac{(\sum x)^2}{n}\right]$

$= \dfrac{1}{35}\left(16125.5 - \dfrac{716.6^2}{36}\right) = 0.384$

$Z = \dfrac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \dfrac{21.16 - 21}{\frac{0.6197}{\sqrt{36}}} = 1.55$

$\therefore |z| < 1.96$ So, Ho accepted

**Name : UDDIN, NESAR**

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19-41759-3 (P-1)

8.1

Here, $N=28$

$n=6$ using random number table

use column 1 from the table. The last serial numbers is of two digit. so we need to select a random number of two digits.

| Random numbers | 11 | 16 | 9 | 12 | 19 | 10 |
|---|---|---|---|---|---|---|
| Pharmacies of selected regions | 20 | 25 | 20 | 18 | 18 | 13 |

i) Estimate of mean, $\bar{x} = \frac{1}{n}\sum x = \frac{114}{6} = 19$ Ans

ii) Estimate total, $\hat{X} = N\bar{x} = 28 \times 19 = 532$ Ans

iii) We know $s^2 = \left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$

$= \frac{1}{5}\left(2242 - \frac{(114)^2}{6}\right)$

$= \frac{1}{5}(2242 - 2166)$

$= \frac{1}{5}(76)$

$= 15.2$

$V(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28 \times 6} \times 15.2 = 1.9905$

The standard error of estimate of mean is,

$S.e(\bar{x}) \sqrt{V(\bar{x})} = \sqrt{1.9905} = 1.4109$ (Ans)

iv) The estimate of standard error of estimate of Population $v(\hat{X}) = N^2 (v(\hat{x}))$

$= 28^2 \times 15.2$

$= 11916.8$

vii) The estimate of proportion of region in which there are less than 18 pharmacies are given by $p = \frac{a}{n} = \frac{1}{6} = 0.17$

Here, a = number of region in the sample in which their are less than 18 Pharmacies $= 1$

## 9.1

Let, $x \sim N(\mu, \sigma^2)$, $\sigma^2$ is unknown.

We need to test, $H_0: \mu_0 = 5$ V $V_1: \mu \neq \mu_0$

$\bar{x} = \frac{1}{n}\sum x \frac{72}{10} = 7.2$ $s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$

$= \frac{1}{9}\left(758 - \frac{72^2}{10}\right)$

$= 26.62$

Test statistic : $t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{7.2 - 5}{\frac{5.16}{\sqrt{10}}} = 1.35$

since $|t| < t_9 = 2.262$. So $H_0$ is accepted.

9.5

$\bar{x} = \frac{761.6}{36} = 21.16$

$s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]$

$= \frac{1}{35}\left\{16125.5 - \frac{(716.6)^2}{36}\right\}$

$= 0.384$

$z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$

$= \frac{21.16 - 21}{\frac{0.6197}{\sqrt{36}}}$

$= 1.5491$

$= 1.55$

$\therefore |z| < 1.96$

So, Ho accepted.

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**ID : 19-41829-3**

Syeda Aynul Karim
19-41829-3



Assignment: 03

# Random number table:

| Random numbers | 11 | 16 | 9 | 12 | 19 | 10 |
|---|---|---|---|---|---|---|
| Pharmacies of selected Regions | 20 | 25 | 20 | 18 | 18 | 13 |

① Mean number of selected Pharmacies per Regions $= (20+25+20+18+18+13)/6$

$= 114/6 = 19$

② Estimate of Total, $\hat{X} = N\bar{x} = 28 \times 19$

$= 532$

③ The standard error of estimate of mean is

$s.e.(\bar{x}) = \sqrt{v(\bar{x})} = \sqrt{1.990} = 1.410$

The variance of sample mean is $v(\bar{x}) = \frac{N-n}{Nn} s^2$

$= \frac{28-6}{28 \times 6} \times 15.2$

$= 1.990$

$s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right] = \frac{1}{6-1}\left(2242 - \frac{(114)^2}{6}\right)$

$= 15.2$

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(4) The estimate of standard error of estimate of population total is given

$$V(\hat{x}) = N^2 v(\bar{x}) = 28^2 \times 1.990$$
$$= 1560.16$$
$$S.e(\hat{x}) = \sqrt{V(\hat{x})} = \sqrt{1560.16} = 39.49$$

(7) Numbers are less than 18 = 16, 13, 15.

$$P = a/n = \frac{\cancel{3}^{1}}{\cancel{6}_{2}} = 0.5$$

Hypothesis Testing method.

Example: 9.1:

Let, $x \sim (\mu, \sigma^2)$, $\sigma^2$ is unknown

$H_0: \mu = \mu_0 = 5$ VS $H_1: \mu \neq \mu_0$

$$\bar{x} = \frac{1}{n}\Sigma x = \frac{72}{10} = 7.2$$

$$S^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right] = \frac{1}{9}\left(758 - \frac{72^2}{10}\right)$$
$$= 26.62.$$

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Testing statistic, $t = \frac{\bar{x} - \mu_0}{S/\sqrt{n}} = \frac{7.2 - 5}{5.16/\sqrt{10}}$

$= 1.35$

Since, $(t) < t_9 = 2.262 \left(t_{n-1} = t_{10-9} = t_9\right]$.

So, $H_0$ is accepted, Hence, the average schooling years can be considered.

Exercise 9.5

$\Sigma x = 761.6$, $\Sigma x^2 = 16125.5$ size $= 36$

$H_0: \mu = \mu_0 = 21$ VS $H_1: \mu \neq \mu_0$

$\bar{x} = \frac{761.6}{36} = 21.56$

$S^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right] = \frac{1}{35}\left[16125.5 - \frac{(761.6)^2}{36}\right]$

$= 0.3837$

$\therefore S = 0.6194$

Test statistics:

$$Z = \frac{\bar{x}-\mu_0}{s/\sqrt{n}}$$

$$= \frac{21.56-21}{0.494/\sqrt{36}} = 5.424$$

$\therefore |Z| > 1.96$. So, $H_1$ is accepted. It's accepted the alternative Hypothesis and $H_0$ is rejected.

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## 8.1

Here, $N = 28$

$n = 6$ using random number Table

let us use column 1 from the table. The last serial number is of two digit, so we need to select a random number of two digits.

| Random numbers | 11 | 16 | 9 | 12 | 18 | 10 |
|---|---|---|---|---|---|---|
| Pharmacies of selected regions. | 20 | 25 | 20 | 18 | 18 | 13 |

1) Estimate of mean, $\bar{x} = \frac{1}{n} \Sigma x = \frac{114}{6} = 19$ (Ans)

2) Estimate total, $\hat{X} = N\bar{x} = 28 \times 19 = 532$ (Ans)

3) We know $s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]$

$$= \frac{1}{5}\left(2292 - \frac{114^2}{6}\right)$$

$$= \frac{1}{5}(2292 - 2166) = \frac{1}{5}(76) = 15.2$$

$$V(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28\times6} \times 15.2 = 1.9905$$

The standard error of estimate of mean is,

$$S.e.(\bar{x}) \sqrt{v(\bar{x})} = \sqrt{1.9905} = 1.4109$$ (Ans)

4) The estimate of standard error of estimate of population $V(\hat{x}) = N^2 (v(\bar{x}))$

$$= 28^2 \times 15.2$$

$$= 11916.8$$

(Ans)

7) The estimate of proportion of regions in which there are less than 18 Pharmacies are given by $p = \frac{a}{n} = \frac{1}{6} = \cancel{0.33}\ 0.17$

Here, $a$ = number of regions in the sample in which there are ~~tow~~ less than 18 Pharmacies

$= 1$

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## 9.1

Let, $x \sim N(\mu, \sigma^2)$, $\sigma^2$ is unknown

We ~~...~~ need to test, $H_0: \mu_0 = 5$ vs $H_1: \mu \neq \mu_0$

$\bar{x} = \frac{1}{n}\sum x \; \frac{72}{10} = 7.2$ $\quad s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$

$= \frac{1}{9}\left(758 - \frac{72^2}{10}\right) = 26.62$

Test statistic : $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{7.2 - 5}{5.16/\sqrt{10}} = 1.35$

since $|t| < t_9 = 2.262$. So $H_0$ is ~~accep~~ accepted.

Hence we can conclude that the average schooling years can be considered as 5.

## 9.5

$\bar{x} = \frac{761.6}{36} = 21.16$

$s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right] = \frac{1}{35}\left(16125.9 - \frac{716.6^2}{36}\right)$

$= 0.384$

$z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{21.16 - 21}{0.6197/\sqrt{36}} = 1.5491 = 1.55$

$\therefore |z| < 1.96$ so, $H_0$ accepted.

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B.W

| Random Numbers | 16 | 11 | 10 | 19 | 17 | 9 |
|---|---|---|---|---|---|---|
| Pharmacies of selected regions | 25 | 20 | 13 | 18 | 15 | 20 |

1. Estimate of mean, $\bar{x} = \frac{1}{n}\sum x = \frac{111}{6} = 18.5$

2. Estimate of total, $x = N\bar{x} = 28 \times 18.5 = 518.0$

3. The standard error of estimate of mean is,

$s.e(\bar{x}) = \sqrt{v(\bar{x})} = \sqrt{2.334} = 1.531$

The variance of same mean is, $v(\bar{x}) = \frac{N-n}{Nn} s^2$

$= \frac{28-6}{28\times6} 17.9 = 2.344$

$s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right] = \frac{1}{5}\left(2143 - \frac{111^2}{6}\right)$

$= 17.9$

4. The estimate of standard error of estimate of population total is given as follows:

$v(\hat{x}) = N^2 v(\bar{x}) = 28^2 \times 2.344 = 1837.696$ and

$s.e(\hat{x}) = \sqrt{v(\hat{x})} = 42.86$

7. The estimate of proportion of regions in which there are less than 18 pharmacies is given by $p = a/n = 2/6 = 0.33$; Here $a$ = number of regions in the sample in which there are less than 18 pharmacies = 2

H.W

| Random Numbers | 11 | 16 | 09 | 12 | 19 | 10 |
|---|---|---|---|---|---|---|
| Pharmacies of selected regions | 20 | 25 | 20 | 18 | 18 | 13 |

1. Estimate the mean: $\bar{x} = \frac{1}{n}\Sigma x = \frac{114}{6} = 19$

2. Estimate of total $\hat{x} = N\bar{x} = 28\times 19 = 532$

3. The standard error of estimate of mean is

$$s.e(\bar{x}) = \sqrt{v(\bar{x})} = \cancel{\sqrt{2.334}} = \sqrt{1.990} = 1.410$$

The variance of sample mean is

$$v(\bar{x}) = \frac{N-n}{Nn}s^2 = \frac{28-6}{28\times 6}\times 15.2 = 1.990$$

$$s^2 = \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right] = \frac{1}{5}\left(2242 - \frac{114^2}{6}\right) = 15.2$$

4. The estimate of standard error of estimate of population total is given as follows

$v(\hat{X}) = N^2 v(\hat{\bar{x}}) = 28^2 \times 1.990 = 1560.16$ and

$s.e(\hat{X}) = \sqrt{v(\hat{X})} = \sqrt{1560.16} = 39.498$

7. The estimate of proportion of region in which there are less than 18 pharmacies given by $p = a/n = 1/6 = 0.166$

## Example 10.1

Let, $x \sim N(\mu, \sigma^2)$, $\sigma^2$ is unknown

We need to test. $H_0: \mu = 5$ vs $H_1: \mu \neq \mu$.

$\bar{x} = \frac{1}{n}\sum x = \frac{72}{10} = 7.2$, $s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$

$= \frac{1}{9}\left(758 - \frac{72^2}{10}\right) = 26.62$

Test, statistic : $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{7.2 - 5}{5.16/\sqrt{10}} = 1.35$

since, $|t| < t_9 = 2.262$, So, $H_0$ is accepted

Hence, we can conclude that the average schooling years can be considered as 5.

## Example 10.5

We need to test. $H_0: \mu = 21$ vs $H_1: \mu = \mu$.

$s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$

$= \frac{1}{35}\left(16125.5 - \frac{(761.6)^2}{36}\right)$

$= \cancel{12.76}\ 0.369$

Test statistics $Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{21.15 - 21}{0.607/\sqrt{36}}$ $\left[\because \bar{x} = \frac{761}{36} = 21.15\right.$

$= 1.482$

Since $|Z| < 1.96$, so $H_0$ is accepted. The population mean 21.