



ASSIGNMENT : 03

**Course : Computational Statistics
And
Probability**

Submitted By,

**Group A
Section : K**

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Subject : _____

Date : _____

$$\begin{array}{ccccccc} 8.1 & 12 & 20 & 5 & 25 & 10 & 35 \\ \hline 1 & 2 & 3 & 4 & 5 & 6 \end{array}$$

① mean of the pharmacists = $107/6 = 17.83$

② Total = $N\bar{x} = 28 \times 17.83 = 532$
 $28 \times 17.83 = 499.24$

③ $s^2 = \frac{1}{n-1} \left[\sum x^2 - \left(\frac{\sum x}{n} \right)^2 \right]$
 $= \frac{1}{5} (2519 - \frac{107^2}{6})$
 $= \frac{1}{5} (2519 - 1908.16)$
 $= 122.168$

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

The standard error of estimate mean is

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

④ $V(\bar{x}) = N^2 s^2 V(\bar{x}) = 28^2 \times 15.99$
 $= 12538.16$

Subject : _____

Date : _____

Q7) 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.

Q.1 Let n a $N(4, \sigma^2)$, σ^2 is unknown

We need to test $H_0: \mu = 110 = 5$ vs $H_1: \mu \neq 110$

$$\bar{x} = \frac{1}{n} \sum x_i = \frac{72}{10} = 7.2, S^2 = \frac{1}{n-1} \left[\sum x_i^2 - \frac{(\sum x_i)^2}{n} \right]$$
$$= \frac{1}{9} (758 - \frac{72^2}{10}) = 26.62$$

$$\text{Test statistics } t: \frac{\bar{x} - 110}{S / \sqrt{n}} = \frac{7.2 - 5}{5.16 / \sqrt{10}} = 1.35$$

Since, $|t| < t_{\alpha/2} = 2.262$. So, H_0 is accepted

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

Subject : _____

Date : _____

Q.5/

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

$$S^N = \frac{1}{n-1} \left[\sum n^N - \frac{(\text{ex})^N}{n} \right] = \frac{1}{35} \left(16125.5 - \frac{716.6^N}{36} \right) \\ = 0.384$$

$$Z = \frac{\bar{x} - 21}{S} = \frac{21.16 - 21}{0.6197} = 1.55$$

$\therefore |Z| < 1.96$ So, H_0 is accepted.

18-39062-3

Problem 8-1Here $N = 28$, $n = 6$

Column 1 from the table. 2nd 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, $\bar{x} = \frac{1}{n} \sum n = \frac{114}{6} = 19$ (Ans)

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

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

$$\begin{aligned} &= \frac{1}{5} [2242 - \left(\frac{114}{6} \right)^2] \\ &= \frac{1}{5} [76] \\ &= 15.2 \end{aligned}$$

$$\begin{aligned} V(\bar{x}) &= \frac{N-n}{Nn} s^2 \\ &= \frac{26-6}{28 \times 6} \times 15.2 \end{aligned}$$

$$= 1.99$$

The standard error of estimated of mean is

$$\begin{aligned} s \times e(\bar{x}) \sqrt{V(\bar{x})} &= \sqrt{1.99} \\ &= 1.41 \text{ (m)} \end{aligned}$$

i)

$$\begin{aligned} \text{Estimate standard error} &= N^{-\frac{1}{2}} [V(\bar{x})]^{1/2} \\ &= 28^{-\frac{1}{2}} \times 15.2 \\ &= 11916^{-\frac{1}{2}} (i) \end{aligned}$$

2)

Estimate of proportion of region in

which there are less than than pharmacies

$$\begin{aligned} \text{are given } p &= \frac{\alpha}{n} = \frac{1}{6} \\ &\rightarrow 0.17 \end{aligned}$$

Hence a - Number of region where photons are less than than $18 - 1$

Ans to the Q no- 9.1

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

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

$$\bar{x} = \frac{1}{n} \sum x_i - \bar{x}^2 = \frac{1}{n-1} \left[\sum x_i^2 - \frac{\sum x_i^2}{n} \right] \\ = \frac{1}{9} \left(255 - \frac{225}{10} \right) \\ = 26.62$$

$$\therefore \chi = \frac{\bar{x} - \mu_0}{S/\sqrt{n}} = \frac{26.62 - 5}{\frac{5.16}{\sqrt{10}}} = 1.35$$

Here H_1 (Agt- 2.263) so H_0 is accepted

∴ average shooting year can be considered as

Problem - 9.5

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

$$= 21.16$$

$$S^2 = \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right]$$
$$= \frac{1}{35} \left(16125.5 - \frac{(216.6)^2}{36} \right)$$
$$= 0.384$$

$$Z = \frac{\bar{x} - \mu_0}{\sqrt{s^2/n}} = \frac{21.16 - 21}{\sqrt{0.6192/36}}$$

$$= 1.55$$

$$|z| < 1.96$$

Accepted

Protick, Hasin Khan

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8.1

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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, $\hat{x} = N\bar{x} = 28 \times 22.83 = 639.33$

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

$$= \frac{1}{5} \left(3325 - \frac{137^2}{6} \right)$$
$$= \frac{1}{5} (3325 - 3128.16)$$
$$= 49.36$$

$$V(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28 \times 6} \times 49.36 = 6.963$$

The standard error of estimate of mean is

$$s.e. (\bar{x}) \sqrt{V(\bar{x})} = \sqrt{6.963} = 2.542$$

iv) The estimate of standard error of estimate

$$\text{of population } V(\hat{x}) = N \{ V(x) \} = 28 \times 6.46 \\ = 5067.626$$

vi) The estimate of proportion of regions in

which there are less than 18 pharmacies are

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

Here a = number of regions in the sample there

are less than 18 pharmacies = 1

9.1

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

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

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

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

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

Since $|t| < t_{\alpha/2} = 2.262$, so H_0 is accepted.

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

9.5

$$\bar{x} = \frac{261.6}{36} = 21.16$$

$$s^2 = \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right] = \frac{1}{36} \left(16125.5 - \frac{216.6^2}{36} \right) \\ = 0.384$$

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

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

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Saikat Mahmud p: 1
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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. $s^2 = \frac{1}{5} \left(2067 - \frac{109^2}{6} \right) = 17.37$

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

SaiKant

p:2

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

$$H_1: \mu \neq \mu_1$$

$$\bar{x} = \frac{1}{n} \sum x = \frac{72}{10} = 7.2, s^2 = \frac{1}{9} \left(758 - \frac{72^2}{10} \right) \\ = 26.62$$

$$t = \frac{7.2 - 5}{5.16/\sqrt{10}} = 1.35. \text{ Since } |t| < t_{0.05/2} = 2.262$$

So, H_0 is accepted.

Saikat

P:3

9.5

we need to test $H_0: \bar{Y} = Y_0 = 21$ vs
 $H_1: \bar{Y} \neq Y_0$

$$\bar{Y} = \frac{761.6}{36} = 21.15, S^2 = \frac{1}{35} \left(16125.5 - \frac{761.6^2}{36} \right) = 0.383$$

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

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

(Ans.)

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①

Assignment - 3

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Problem: 8.1/

Here,

$$N = 28$$

$n = 6$ [using random number table]

Using column 'A' 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

- Estimate of mean, $\bar{x} = \frac{1}{n} \sum x_i = \frac{114}{6} = 19$. Ans
- Estimate total, $\hat{N} = N\bar{x} = 28 \times 19 = 532$ Ans
- We know, $s^2 = \frac{1}{n-1} \left[\sum x_i^2 - \frac{(\sum x_i)^2}{n} \right]$
 $= \frac{1}{5} \left[2292 - \frac{(114)^2}{6} \right]$
 $= \frac{1}{5} (76)$
 $= 15.2$.

(2)

$$V(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28 \times 6} \times 15.2 = 1.0905$$

The standard error of estimated of mean is,

$$S.E.(\bar{x}) = \sqrt{V(\bar{x})} = \sqrt{1.0905} = 1.0411$$

4. The estimate of standard error of estimate of population $V(\bar{x}) = N^{-1} V(\bar{x})$

$$\therefore (10.4 - 6.0211) = \frac{28 \times 15.2}{110.128}$$

7. The estimate of population proportion of regions in which there are less than 18 pharmacies are given by $P = \frac{\alpha}{n} = \frac{1}{6} = 0.17$

Here,

α = number of regions in the sample in which there are less than 18 pharmacies = 1

Problem:

Q.1 Let,

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

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

$$\begin{aligned}\bar{x} &= \frac{1}{n} \sum x = \frac{72}{10} = 7.2 \\ S^2 &= \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right] \\ &= \frac{1}{9} (758 - \frac{72^2}{10}) \\ &= 26.62\end{aligned}$$

(3)

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

Since $|t| < t_{0.05/2} = 2.202$, so H_0 is accepted.

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

Problem: Q.5

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

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

$$Z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{21.16 - 21}{\frac{0.6167}{\sqrt{36}}} = 1.55 \text{ with d.f. } n-1 = 35$$

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

Similarly it can be shown that null hypothesis

$$\begin{aligned} H_0: \mu &\leq 20, (\text{D.F.}) \\ H_A: \mu &> 20, (\text{D.F.}) \\ \text{Test statistic: } t &= \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{21.16 - 20}{\frac{0.6167}{\sqrt{36}}} = 2.16 \end{aligned}$$

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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 selected regions	20	25	36	18	24	75

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

ii) Estimate total $T = N\bar{x} = 28 \times 22.83 = 333.72$

$$\begin{aligned}\text{iii) We know } s^2 &= \frac{1}{n-1} \left[\sum x_i - \frac{(x_i)}{n} \right] \\ &= \frac{1}{5} \left(333.72 - \frac{137}{6} \right) \\ &= 99.36\end{aligned}$$

$$V(\bar{x}) = \frac{N-n}{N_n} s^2 = \frac{28-6}{28 \times 6} \times 95.36 = 6.963$$

The standard error of estimate $s_e = \sqrt{V(\bar{x})} = \sqrt{6.963} = 2.6392$

S.E. (t) $\sqrt{V(\bar{x})} = \sqrt{6.963} = 2.6392$

~~Let~~ $t = \frac{\bar{x} - \mu_0}{s_e}$ is test statistic

Let $n = N$ (approx) & take we need to assume σ^2 is unknown to test $H: \mu = \mu_0$

\bar{x}	$\sum x_i$	s^2	$t = \frac{\bar{x} - \mu_0}{s_e}$
71.52	72	7.2	Test statistic
28	88	10	mean test

$$s_e = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2} = \sqrt{\frac{1}{27} (758 - 72^2)} = 1.35$$

~~Test~~ Test: $H_0: \mu = \mu_0$ vs $H_1: \mu \neq \mu_0$

$$\text{S.E. } t = \frac{\bar{x} - \mu_0}{s_e} = \frac{71.52 - 70}{1.35} = 1.14$$

$$\text{Since } 1.14 < t_{0.05/2} = 2.201 \text{ So } H_0 \text{ is accepted}$$

Hence we can conclude that the average schooling years

can be considered as s.

$$\frac{9.5}{n} = \frac{211.6}{32} = 21.16$$

$$s^2 = \frac{1}{n-1} \left[\sum_{i=1}^n (x_i - \bar{x})^2 \right] = \frac{1}{31} (16125.5 - \frac{716.8}{32})$$

$$Z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = 0.184$$

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

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Jannatuil Ferdouse Jannat

P-1

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(Q)

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 $T = N \bar{x} = 28 \times 19$

$$\text{S.E. } S.E.(\bar{x}) = \sqrt{\frac{\sigma^2}{n}} = \sqrt{\frac{53.2}{6}} = 1.990$$

The variance of sample mean is.

$$S.E.(\bar{x}) = \sqrt{\frac{\sigma^2}{n}} = \sqrt{\frac{53.2}{6}} = 1.990$$

$$= \frac{1}{6-1} \left[\sum x_i^2 - \frac{(\sum x_i)^2}{6} \right] = 15.2$$

$$\textcircled{4} \quad V(x^n) = N^2 V(\bar{x}) = 28^2 \times 1.998$$

$$S.E(\bar{x}) = \sqrt{V(\bar{x})} = \sqrt{1560.16} = \sqrt{1560.16}$$

$$\textcircled{5} \quad \text{No. are less than } B = 16, 13, 5$$

$$P = \frac{\alpha}{n} = \frac{3}{85} = 0.035$$

$$\text{Hypothesis testing method}$$

Q. 1: Let μ and σ^2 be known,

S.P.I. unknown,

$H_0: \mu_0 = 15$ vs. $H_1: \mu \neq \mu_0$

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i = \frac{72}{10} = 7.25$$

$$S.P.I. = \frac{1}{n} \left[\sum_{i=1}^n (x_i - \bar{x})^2 \right]$$

$$\begin{aligned} S.P.I. &= \frac{1}{9} \left(758 - \frac{722}{10} \right) \\ &= 26.62 \end{aligned}$$

P-3

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

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

since $|t| < t_{\alpha/2} = 2.262$. so H_0 is accepted. we can conclude that the average schooling years can be consider as 5.

Q5 $\bar{x} = \frac{761.6}{36} = 21.16$

$$s^2 = \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right] \textcircled{*}$$
$$= \frac{1}{35} (16125.5 - \frac{716.6^2}{36}) = 0.384$$
$$Z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{21.16 - 21}{\frac{0.6197}{\sqrt{36}}} = 1.55$$

$\therefore |Z| < 1.96$ so, H_0 accepted

Name : UDDIN, NESAR

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19-41759-3 (P-1)

8.1

Hence, $N=28$

$n=6$ using random number table
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	03	12	19	10
Pharmacies of selected region	20	25	20	18	18	13

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

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

iii) We know $s^2 = \left[\sum n^2 - \frac{(\sum n)^2}{n} \right]$
 $= \frac{1}{5} (2242 - \frac{114^2}{6})$
 $= \frac{1}{5} (2242 - 2166)$
 $= \frac{1}{5} (76)$
 $= 15.2$

$$V(\bar{x}) = \frac{N-n}{Nn} s^2 = \frac{28-6}{28 \times 6} \times 15.2 = 1.0905$$

The standard error of estimate of mean is,

$$S.E (\bar{x}) = \sqrt{V(\bar{x})} = \sqrt{1.0905} = 1.4105 \text{ (Ans)}$$

iv) The estimate of standard error of estimate of
 Population $\sigma(\bar{x}) = N^{\frac{1}{2}} (\sigma(\hat{x}))$
 $= 28^{\frac{1}{2}} \times 15.2$
 $= 119.68$

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

$$\underline{0.1}$$

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

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

$$\begin{aligned}\bar{v} &= \frac{1}{n} \sum v = \frac{72}{10} = 7.2 \quad s^2 = \frac{1}{n-1} \left[\sum v^2 - \frac{(\sum v)^2}{n} \right] \\ &= \frac{1}{9} \left(758 - \frac{72^2}{10} \right) \\ &= 26.62\end{aligned}$$

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

since $|t| < t_{0.05} = 2.262$. So H_0 is accepted.

19-41759-3 (P-3)

9.5

$$\bar{u} = \frac{761.6}{36} = 21.16$$
$$S^v = \frac{1}{n-1} \left[\sum u^v - \frac{(\bar{u})^v}{n} \right]$$
$$= \frac{1}{35} \left\{ 16125.5 - \frac{(716.6)^v}{36} \right\}$$

$$= 0.384$$

$$z = \frac{\bar{u} - u_0}{\frac{s}{\sqrt{n}}}$$
$$= \frac{21.16 - 21}{\frac{0.6107}{\sqrt{36}}}$$

$$= 1.5401$$

$$= 1.55$$

$$\therefore |z| < 1.96$$

So, H_0 accepted.

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Pg. 01

E-CS81A-01

Assignment : 03

Random number table :

Random numbers	11	16	19	12	19	10
Pharmacies of Selected Regions	20	25	20	18	18	13

① Mean number of selected Pharmacies per Regions

$$\bar{x} = \frac{(20+25+20+18+18+13)}{6}$$

$$= 11.9$$

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

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

$$= 1.990$$

$$S^2 = \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right] = \frac{1}{6-1} \left(2242 - \frac{(119)^2}{6} \right)$$

$$= 15.2$$

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

$$V(\bar{x}) = N V(\bar{x}) = 28 \times 1.990 \\ = 1560.16$$

$$S.e(\bar{x}) = \sqrt{V(\bar{x})} = \sqrt{1560.16} = 39.99$$

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

$$P = a/n = \frac{3}{8} = 0.5$$

Hypothesis Testing method.

Example: 9.1:

Let, $x \sim (4, \sigma^2)$, σ^2 is unknown

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

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

$$S^2 = \frac{1}{n-1} \left[\sum x_i^2 - \frac{(\sum x_i)^2}{n} \right] = \frac{1}{9} \left(758 - \frac{72^2}{10} \right)$$

$$= 26.62$$

10-91829-3

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

$$= 1.35$$

Since, $t < t_{0.9} = 2.2262$ ($t_{n-1} = t_{10-9} = t_9$)

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

Exercise 9.5

$$\sum x = 761.6, \sum x^2 = 16125.5 \text{ size} = 36$$

$$H_0: M = \mu_b = 21 \text{ VS } H_1: M \neq \mu_b$$

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

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

$$= 6.3837$$

$$\therefore S = 0.6194$$

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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1

$$S_{\text{sample}} = S_{\text{population}} \times \frac{\sqrt{N-1}}{\sqrt{n-1}} = 8 \times \frac{\sqrt{28-1}}{\sqrt{6-1}} = (8) \sqrt{7}$$

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, $\bar{x} = \frac{1}{n} \sum x = \frac{119}{6} = 19$ (Ans)

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

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

$$\begin{aligned} &= \frac{1}{5} \left(2292 - \frac{119^2}{6} \right) \\ &= \frac{1}{5} (2292 - 2166) = \frac{1}{5} (76) = 15.2 \end{aligned}$$

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

The standard error of estimate of mean is,

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

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

or	8	81	64	31	16	$= 28^2 \times 15.2$
EI	8	81	64	32	16	$= 11916.8$ (Ans)

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

Here, a = number of regions in the sample in which there are less than 18 pharmacies

$$\therefore P = \frac{1}{6} = \frac{(2218 - 2128)}{2218} =$$

9.1

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

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

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

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

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

since $|t| < t_{\alpha/2} = 2.262$. So H_0 is ~~not~~ accepted.

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

9.5

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

$$s^2 = \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right] = \frac{1}{35} \left(16129.9 - \frac{716.6^2}{36} \right)$$

$$= 0.389$$

$$z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{21.16 - 21}{0.6197/\sqrt{36}} = 1.5991 = 1.55$$

$\therefore |z| < 1.96$ 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, $v(\bar{x}) = \frac{N-n}{Nn} s^2$

$$s^2 = \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right] = \frac{1}{5} (2148 - \frac{111^2}{6})$$

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

$$v(\bar{x}) = N v(\bar{x}) = 28 \times 2.344 = 1832.696 \text{ and}$$

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

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

$0.33 = \frac{11}{33} = 0.3333$, more than 1/3.

$0.33 - 0.019 = 0.311$, total of 3 territories.

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

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

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

3. The standard error of estimate of mean is

$$S.E(\bar{x}) = \sqrt{N(\bar{x})} = \sqrt{2.334} = \sqrt{1.990} = 1.410$$

The variance of sample mean is

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

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

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

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

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

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

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

$$\bar{x} = \frac{1}{n} \sum x = \frac{22}{10} = 2.2, s^2 = \frac{1}{n-1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right]$$

$$= \frac{1}{9} \left(258 - \frac{22^2}{10} \right) = 26.62$$

Test statistic: $t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{2.2 - 5}{5.16/\sqrt{10}} = 1.35$

since, $|t| < t_0 = 2.262$. 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 $H_1: \mu \neq 21$.

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

$$= \frac{1}{35} \left(16125.5 - \frac{(261.6)^2}{35} \right)$$

$$= 12.76 \quad 0.369$$

Test statistics $Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{21.15 - 21}{0.608/\sqrt{36}} = 1.482$

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