UNIVERSITY OF KARACHI

Probability and Statistical Methods

BSCS-306

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ASSIGNMENT : 05

SAMPLING AND SAMPLING DIST. FOR SAMPLE MEAN :-

QUESTION : 01

Sampling Without Repition :-

My seal no. is B20102077

Sample : 7 , 14 , 21 , 28 , 35 .

S. No	Sample	Mean.
1	(7 , 14)	10.5
2	(7 , 21)	14
3	(7 , 28)	17.5
4	(7 , 35)	21
5	(14 , 21)	17.5
6	(14 , 28)	21
7	(14 , 35)	24.5
8	(21 , 28)	24.5
9	(21 , 35)	28
10	(28 , 35)	31.5

Mean = $\bar{x}$ = ~~P($\bar{x}$)~~	10.5	14	17.5	21	24.5	28	31.5
P($\bar{x}$)	0.1	0.1	0.2	0.2	0.2	0.1	0.1

Sampling ~~without~~ Repitition:

$N^n = 5^2 = 25$

Sample: 7, 14, 21, 28, 35

S.No	Sample	Mean
1	(7, 14)	10.5
2	(7, 21)	14
3	(7, 28)	17.5
4	(7, 35)	21
5	(14, 7)	10.5
6	(14, 21)	17.5
7	(14, 28)	21
8	(14, 35)	24.5
9	(21, 7)	14
10	(21, 14)	17.5
11	(21, 28)	24.5
12	(21, 35)	28
13	(28, 7)	17.5
14	(28, 14)	21
15	(28, 21)	24.5
16	(28, 35)	31.5
17	(35, 7)	21
18	(35, 14)	24.5
19	(35, 21)	28
20	(35, 28)	31.5
21	(7, 7)	7
22	(14, 14)	14
23	(21, 21)	21
24	(28, 28)	28
25	(35, 35)	35

$\bar{x}$	10.5	14	17.5	21	24.5	28	31.5	7	35
$P(\bar{x})$	0.08	0.12	0.16	0.2	0.16	0.12	0.08	0.04	0.04

QUESTION : 02

$\mu = 800$ hours.

$\sigma = 40$ hours

$n = 16$

$x = 775$ hours.

$$P(x < 775) = P\left(z < \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}\right)$$

$$= P\left(z < \frac{775 - 800}{40/\sqrt{16}}\right)$$

$$= P(z < -2.5)$$

$$= 0.0062$$

QUESTION : 03

$\sigma = 5.6$ kg.

(a) increased from 64 to 196.

$$V(\bar{x}) = \frac{\sigma^2}{n} \qquad n_1 = 64 \; , \; n_2 = 196$$

$$V(\bar{x})_1 = \frac{(5.6)^2}{64}$$

$$\boxed{V(\bar{x})_1 = 0.49}$$

$$V(\bar{x})_2 = \frac{(5.6)^2}{196}$$

$$\boxed{V(\bar{x})_2 = 0.18}$$

(b) Decreased from 784 to 49.

$n_1 = 784$, $n_2 = 49$

$$V(\bar{x})_1 = \frac{(5.6)^2}{784} = \boxed{0.04}$$

$$V(\bar{x})_2 = \frac{(5.6)^2}{49} = \boxed{0.64}$$

QUESTION : 04

$\mu = 240ml$, $\sigma = 15ml$

$n = 40$, $\bar{x} = 236ml$

$$Mean = \mu\bar{x} + \sigma\bar{x}$$

$$\sigma\bar{x} = \frac{\sigma}{\sqrt{n}} = \frac{15}{\sqrt{40}} = 2.372$$

$$Mean_1 = 240 + 2.372 \quad , \quad Mean_2 = 240 - 2.372$$

$$Mean_1 = 242.372 \quad , \quad Mean_2 = 237.682$$

Result shows that the value of $\bar{x} = 236ml$ isn't reasonable and the machine require adjsments.

QUESTION : 05

$n = 25$

(a) $x = \mu = 174.5$ cm , $\sigma = 6.9$ cm

$$\sigma_x = \frac{6.9}{\sqrt{25}}$$

$$\boxed{\sigma_x = 1.38 \text{ cm}}$$

(b) $P(172.5 < x < 175.8)$

$$= P\left(\frac{\bar{x} - \mu}{\sigma_x} < z < \frac{\bar{x} - \mu}{\sigma_x}\right)$$

$$= P\left(\frac{172.5 - 174.5}{1.38} < z < \frac{172.5 - 174.5}{1.38}\right)$$

$$= P(-1.45 < z < 0.94)$$

$$= 0.8264 - 0.07353$$

$$= 0.75827$$

No. of samples $= (200)(0.75827)$

$= 151.65$

No. of sample Mean ≤ 152

(c) $P(x < 172) = P\left(z < \frac{172 - 174.5}{1.38}\right)$

$= P(z < -1.81)$

$= 0.03515$

No. of sample Mean $= (200)(0.03515)$

$= 7$ Ans

QUESTION : 06

(a) Mean $= \mu = E(x) = \sum_{x=1}^{n} x \cdot P(x)$

$\mu = (4)(0.2) + (5)(0.4) + (6)(0.3) + 7(0.1)$

$\boxed{\mu = 5.3}$ ★

$E(x^2) = \sum_{x=1}^{n} x^2 P(x) = 28.9$

$V(x) = E(x^2) - [E(x)]^2$

$= 28.9 - (5.3)^2$

$\boxed{V(x) = 0.81}$ ★

(b) $\mu_{\bar{x}} = \mu_x = \boxed{5.3}$

$$\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n} = \frac{0.81}{36}$$

$$\boxed{\sigma_{\bar{x}}^2 = 0.0225}$$

(c) $$P(\bar{x} < 5.5) = P\left(z < \frac{5.5 - 5.3}{\sqrt{0.0225}}\right)$$

$$= P(z < 1.333)$$

$$\boxed{P(\bar{x} < 5.5) = 0.9082}$$

QUESTION : 07

$\mu = 7 \qquad \sigma = 1$

(a) $n = 9$

$$P(6.4 < \bar{x} < 7.2) = P\left(\frac{6.4 - 7}{1/\sqrt{9}} < z < \frac{7.2 - 7}{1/\sqrt{9}}\right)$$

$$= P(-1.8 < z < 0.6)$$

$$= P(z < 0.6) - P(z < -1.8)$$

$$= 0.7580 - 0.03593$$

$$= 0.722$$

(b) $z = \frac{15}{100} \times 7$

$z = 1.05$

$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$

$1.05 = \frac{x - 7}{1/\sqrt{9}}$

$\boxed{x = 7.35}$

QUESTION : 08

mean = $p = 3.2$ min

$\sigma = 1.6$ min

$n = 64$

(a) $P(x < 2.7) = P\left(z < \frac{2.7 - 3.2}{1.6/\sqrt{64}}\right)$

$= P(z < -2.5)$

$= 0.0062$

(b) $P(x > 3.5) = 1 - P(x \leq 3.5)$

$= 1 - P\left(z \leq \frac{3.5 - 3.2}{1.6/\sqrt{64}}\right)$

$= 1 - P(z \leq 1.5)$

$= 1 - 0.9332$

$= 0.0668$

(c) $P(3.2 < x < 3.4) = P(x < 3.4) - P(x < 3.2)$

$= P\left(z < \frac{3.4 - 3.2}{0.2}\right) - P\left(z < \frac{3.2 - 3}{0.2}\right)$

$= P(z < 1) - P(z < 0)$

$= 0.84134 - 0.5$

$= 0.3413$

QUESTION : 09

$\mu = 0.2\text{gm}$, $\sigma = 0.1\text{gm}$

$n = 50$, $\bar{x} = 0.23\text{gm}$

$P(\bar{x} > 0.23) = 1 - P(x \leq 0.23)$

$= 1 - P\left(z \leq \frac{0.23 - 0.2}{0.1/\sqrt{50}}\right)$

$= 1 - P(z < 2.12)$

$= 1 - 0.9830$

$= 0.017$

Hence probablity have such observations given mean $\mu = 0.20$ is small.
Therefore mean value is likely to be false.

QUESTION : 10

(a) $\mu = 540$ $\sigma = 50$.

$n_1 = 32$. $n_2 = 50$.

According to CLT.

$$\mu_1 - \mu_2 = 540 - 540 = 0$$

$$\sigma_{x_1 - x_2} = \sqrt{\frac{\sigma^2}{n_1} + \frac{\sigma^2}{n_2}}$$

$$= \sqrt{\frac{(50)^2}{32} + \frac{(50)^2}{50}}$$

$$\sigma_{x_1 - x_2} = 11.31$$

$$Z_1 = \frac{-20}{11.31} = -1.77, \quad Z_2 = \frac{20}{11.31} = 1.77$$

$$P(|\bar{x}_1 - \bar{x}_2| > 20) = 2P(z < -1.77)$$
$$= 2(0.0384)$$
$$= 0.0761$$

(b) $z_1 = 5/11.319 = 0.44$

$z_2 = 10/11.319 = 0.88$

$$P(-10 < |\bar{x}_1 - \bar{x}_2| < -5) + P(5 < |\bar{x}_1 - \bar{x}_2| < 10)$$
$$= 2P(5 < \bar{x}_1 - \bar{x}_2 < 10)$$
$$2P(5 < \bar{x}_1 - \bar{x}_2 < 10) = 2(P\{0.44 < \bar{x}_1 - \bar{x}_2 < 0.88)$$
$$2P(5 < \bar{x}_1 - \bar{x}_2 < 10) = 2(0.8106 - 0.67)$$
$$2P(5 < \bar{x}_1 - \bar{x}_2 < 10) = 0.2812 \text{ Ans.}$$