

e.g. Suppose the average daily production of oils from 5 wells is

2, 4, 6, 8, 10 (1,000 barrels)

a. Take a sample size 2 ( $n=2$ ) from the population of 5 and construct the probability distribution of the sample mean.

	Sample	Sample Mean	Sample mean	probability $\bar{X}$
1	2, 4	3	3	$\frac{1}{10}$
2	2, 6	4	4	$\frac{1}{10}$
3	2, 8	5	5	$\frac{2}{10}$
4	2, 10	6	6	$\frac{2}{10}$
5	4, 6	5	7	$\frac{2}{10}$
6	4, 8	6	8	$\frac{1}{10}$
7	4, 10	7	9	$\frac{1}{10}$
8	6, 8	7		
9	6, 10	8		
10	8, 10	9		

$K=10$

b. Calculate the expected value of the sample means for  $n=2$ .

$$E(\bar{X}) = \frac{1}{K} \sum_{j=1}^K \bar{X}_j = \frac{1}{10} [3+4+5+6+5+6+7+7+8+9] = 6$$

c. Calculate standard error of sampling means

can be computed w/out  $\sigma$  knowledge

$$\sigma_{\bar{X}} = \sqrt{\frac{\sum_{j=1}^K (\bar{X}_j - \mu)^2}{K}} = \sqrt{\frac{(3-6)^2 + (4-6)^2 + 2 \times (5-6)^2 + 2 \times (6-6)^2 + 2 \times (7-6)^2 + (8-6)^2 + (9-6)^2}{10}} = \sqrt{\frac{30}{10}} = \sqrt{3} = 1.732$$

d. Calculate population standard deviation

(5)

$$\sigma = \sqrt{\frac{\sum_{i=1}^N (X_i - \mu)^2}{N}} = \sqrt{\frac{(2-6)^2 + (4-6)^2 + (6-6)^2 + (8-6)^2 + (10-6)^2}{5}}$$

$$= \sqrt{8} = 2.828$$

e. Use the appropriate formula to calculate the standard error of the sample means

Since  $N=5$ ,  $n=2$ .  $n$  is 40% of  $N$ .

→ Use "not small sample size" formula

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}} = \frac{2.828}{\sqrt{2}} \sqrt{\frac{5-2}{5-1}} = 2 \sqrt{\frac{3}{4}}$$

$$= 1.732 \quad // \quad \leftarrow \text{compare w/ the answer in c.}$$

f. What's the probability that the sample mean of the daily production of oil is less than ~~4,000~~ 5,000 barrels.

$$\bar{X} = \frac{5,000}{5}$$

$$\mu = 6$$

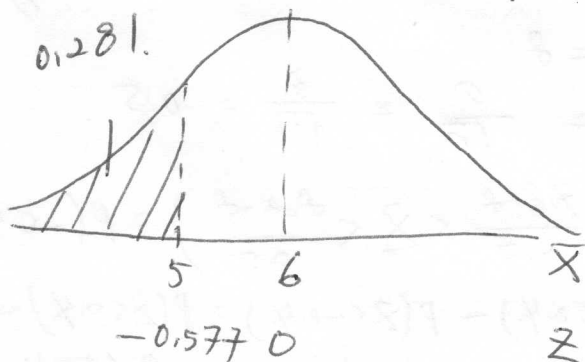
$$Z = \frac{5-6}{1.732} = -0.577$$

$$\sigma_{\bar{x}} = 1.732$$

$$P(\bar{X} < 5) = P(Z < -0.577)$$

$$= P(Z > 0.577) = 1 - P(Z < 0.577)$$

$$= 1 - 0.7190 = 0.281$$



28.1%