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
1	2, 4	3
2	2, 6	4
3	2, 8	5
4	2, 10	6
5	4, 6	5
6	4, 8	6
7	4, 10	7
8	6, 8	7
9	6, 10	8
10	8, 10	9

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

$K = 10$

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

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

c. Calculate standard error of sampling means

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

can be computed w/out σ knowledge

$$= \sqrt{\frac{30}{10}} = \sqrt{3} = 1.732 .$$

d. Calculate population standard deviation

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

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

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

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}\sqrt{\frac{N-n}{N-1}} = \frac{\overset{\sqrt{8}}{\cancel{2.828}}}{\sqrt{2}}\sqrt{\frac{5-2}{5-1}} = 2\sqrt{\frac{3}{4}}$$

$$= 1.732 \;//$$ ← compare w/ the answer in c.

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

$\bar{X} = \cancel{5000}\ 5$

$\mu = 6$

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

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

$$P(\bar{X}<5) = P(Z<-0.57\overset{8}{\cancel{7}})$$

$$= P(Z>0.57\overset{8}{\cancel{7}}) = 1-P(Z<0.57\overset{8}{\cancel{7}})$$

$$= 1-0.7190 = 0.281$$

$\boxed{28.1\%}$