In these questions, if it is asking for the probability of a <u>sample proportion</u> falling in some region, use the following for the mean and the standard error. of the sampling distribution.

Mean = p (population proportion)

Standard error = $\sqrt{\frac{p(1-p)}{n}}$ n - sample size.

If it is asking for the probability of a <u>sample mean</u> falling in the same region, use the following for the mean and the standard ~~deviation~~ error of the sampling distribution.

Mean = μ (population mean)

Standard error = $\frac{\sigma}{\sqrt{n}}$ σ - standard deviation of the population
n - sample size.

1) The question is asking about the likelihood of finding a sample with a sample proportion $\leq \frac{25}{950} = 0.026$

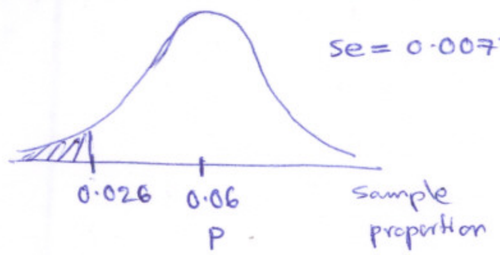
To calculate the z-score we need the mean and the standard error for the sampling distribution.

Mean $= p = 0.06$ $\qquad n = 950$

$$se = \sqrt{\frac{0.06(1-0.06)}{950}}$$

$$= 0.0077$$

se $= 0.0077$



Therefore z-score for 0.026 is

$$z = \frac{0.026 - 0.06}{0.0077} = -4.41.$$

Almost all the data lie within 3 standard deviations from the mean. That is between $z = (-3, 3)$.

Therefore almost all the posible sample proportions we are likely to find are within $z = (-3, 3)$.

therefore since $z = -4.41$, it is unlikely to find the proportion 0.026 in a sample.

Since the question is asking whether it is unlikely, the answer is

A) Yes it is unlikely, $z = -4.41$.

2) This question is talking about the mean and the standard error for a sample distribution of a sample proportion.

$p = 0.21$

$n = 400$.

therefore mean $= p = 0.21$

standard error $= \sqrt{\dfrac{0.21(1-0.21)}{400}} = 0.02$

Therefore the answer is (A)

3) I) Incorrect since the population distribution is not affected by the sample size.

II) The sample distribution of $\bar{x}$ is normal only for $n \geq 30$. Therefore incorrect.

III) sample mean has a mean equal to the population mean μ. Therefore true.

The answer is (B)

4) I) Sampling distribution of a sample mean has a standard deviation given by $\frac{\sigma}{\sqrt{n}}$. Therefore when n is increased, the standard deviation decreases, Therefore the spread of $\bar{x}$ will be less and hence $\bar{x}$ tends to fall closer to its mean which is the population mean.

Therefore true.

II) From the central limit theorem, the shape of the sampling distribution is approximately normal if $n \geq 30$, regardless of the shape of the population distribution. Therefore the sampling distribution does not approximate the population distribution when n is large. Incorrect.

III) standard error $= \dfrac{\sigma}{\sqrt{n}}$ or $= \sqrt{\dfrac{p(1-p)}{n}}$

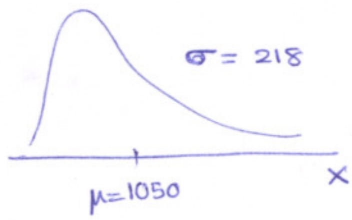
Sample mean

sample proportion.

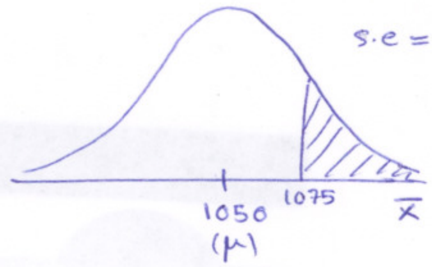
Therefore when n is increased s.e is decreased. Therefore true.

Therefore the answer is (E)

5)



Population Distribution



$s.e = \frac{218}{\sqrt{50}} = 30.83$

$z = \frac{1075 - 1050}{30.83} = 0.81$

Area to the left $= 0.7910$

Area shaded $= 1 - 0.7910$

$= 0.2090$

(B)

6) $\bar{X}$ – is a statistic. (A numrical summary of a sample).

So is a sample proportion.

Therefore true.

7) This question is asking for the mean and the standard deviation for a sampling distribution of a sample mean.

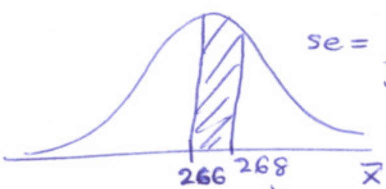
Therefore mean $= \mu = 1050$

se $= \frac{218}{\sqrt{50}} = 30.83$ $\left(se = \frac{\sigma}{\sqrt{n}}\right)$

(D) (center = mean, spread = standard deviation).

8) This is a sample mean question. If $n \geq 30$, the sample distribution is normal,

$n = 100$



$se = \frac{25}{\sqrt{100}} = 2.5$

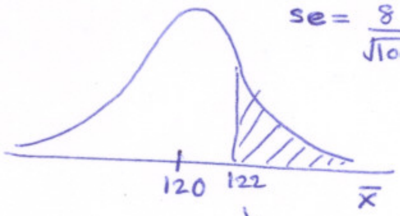
$z_1 = \frac{268 - 266}{2.5} = \frac{2}{2.5} = 0.8 \Rightarrow$ cumulative probability $= 0.7881$

$z_2 = \frac{266 - 266}{2.5} = 0 \Rightarrow$ cumulative probability $= 0.5$

Therefore the shaded area is $0.7881 - 0.5 = 0.2881$

(D)

9) Sample mean question . (Similar to 8 to some extent)



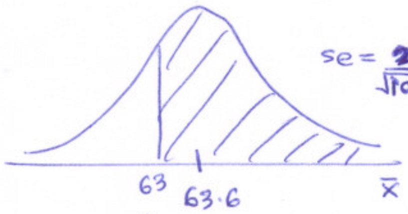
$se = \frac{8}{\sqrt{100}} = 0.8$ $n = 100$

$z = \frac{122-120}{0.8} = \frac{2}{0.8} = 2.5 \Rightarrow$ area to the left $= 0.9938$

Therefore area to the right $= 1 - 0.9938 = 0.0062$ (C)

10) Similar to (9)

$n = 100$



$se = \frac{2.5}{\sqrt{100}} = 0.25$

$z = \frac{63-63.6}{0.25} = \frac{-0.6}{0.25} = -2.4 \Rightarrow$ area to the left $= 0.0082$

Therefore the shaded area $= 1 - 0.0082$

$= 0.9918$

(C)

11) (A) is true

(B) The shape of the sample distribution is approximately normal <u>only</u> if $n \geq 30$.

(C) s.d of a sampling distribution of sample mean $= \frac{\sigma}{\sqrt{n}}$. False.

(D) Not true.

(A) $\leftarrow$ answer.

12) Central limit theorem says regardless of the shape of the population distribution, the sampling distribution will be normal for large samples.

Therefore (A), (B) false since we are not disregarding the sample size.
(C) We are not disregarding the sampling distribution shape. False
(D) True

Answer. (D).

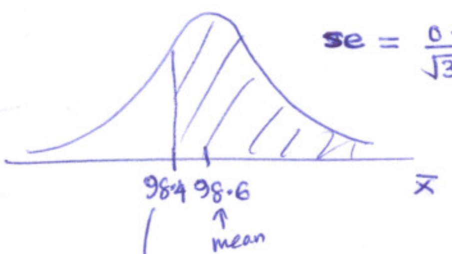
13) Forget this for the time being.

14). The question is asking for the mean and the standard deviation for a sampling distribution of a sample proportion. $n = 1000$

$$\text{mean} = p = 0.7$$

$$se = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{(0.7)(0.3)}{1000}} = 0.0145.$$

15) Sample mean question (similar to (9) and (10))



$$se = \frac{0.6}{\sqrt{36}} = 0.1$$

$$z = \frac{98.4 - 98.6}{0.1} = -2 \Rightarrow \text{area to the left} = 0.0228$$

Therefore area to the right $= 1 - 0.0228$

$= 0.9772$

(D)

16) $\text{Mean} = \mu = 50$

$$se = \frac{\sigma}{\sqrt{n}} = \frac{20}{\sqrt{100}} = 2$$

($n = 100$. Therefore the sampling distribution is approximately normal).

(A)