

You have 25 minutes. Take your time!

Note that this page has TWO sides!

Name: A Student

ONE: The statistic  $\bar{x}$  is a measure of centre, and  $s$  and  $s_{\bar{x}}$  are both measures of spread or variability.

1) name each statistic, and indicate which parameter each statistic is an estimator of:

a)  $\bar{x}$  is called the sample mean and is an estimator of  $\mu$

b)  $s$  is called the sample std. dev. and is an estimator of  $\sigma$

c)  $s_{\bar{x}}$  is called the std. error of the mean and is an estimator of  $\sigma_{\bar{x}}$

2) According to the Central Limit Theorem,  $s$  and  $s_{\bar{x}}$  are related. How?

$$s_{\bar{x}} = \frac{s}{\sqrt{n}}$$

TWO: Three groups of students took samples of soil bulk density (in  $\text{kg}\cdot\text{l}^{-1}$ ) from randomly selected points on skid trails in a block after a timber sale on the school forest.

group	mean	st.dev.	n	std.err.
1	0.9544421	0.3065313	10	0.0969337
2	0.9090369	0.1698814	10	0.0537212
3	0.8859976	0.2202800	20	0.0492561

a) Which group's estimate of the mean has the greatest precision? Why?

group 3: they have the lowest std. error

b) The true mean bulk density is  $0.892 \text{ kg}\cdot\text{l}^{-1}$ . Which group's estimate is the least biased? Why?

group 3:  $0.892$  is closest to  $0.8859976$

THREE: Two ways of expressing a confidence interval are:

a)  $\bar{x} \pm t_{\alpha/2, n-1} \cdot s_{\bar{x}}$     b)  $\bar{x} \pm z_{\alpha/2} \cdot s_{\bar{x}}$

What is the difference between them? Explain.

use (a) when  $n < 100$  (or so);

otherwise use (b)

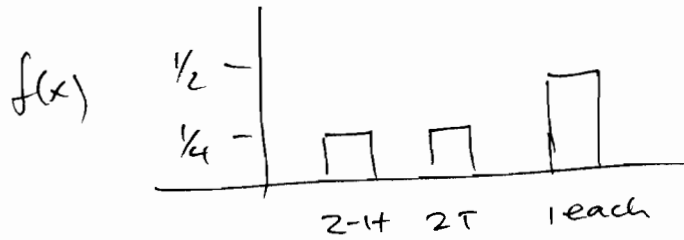
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FOUR: I flip two fair coins, and count the number of heads and tails. Order doesn't matter.

a) What are the possible outcomes?

- ① 2 Heads
- ② 2 Tails
- ③ one of each

b) Draw a probability density histogram. Label it fully.



Write nothing below this line.