Statistics 300

Quiz #9 **Name:** Solution

(6 points : 10 minutes)

1. **Complete the following table.**

	μ	σ	n	$\mu_{\bar{x}}$	$\sigma_{\bar{x}}$
(a)	216	27	81	216	3
(b)	200	27	9	200	9
(c)	216	27	81	216	3
(d)	200	27	9	200	9
(e)	88	27	81	88	3
(f)	1023	27	9	1023	9
(g)	500	43	15	500	11.1
	the population mean	**the population standard deviation**	**the sample size**	**the mean of all possible sample means**	**the standard deviation of all possible sample means**

$\mu_{\bar{x}} = \mu$

$\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$

$\sigma = \sigma_{\bar{x}}\sqrt{n}$

$n = \left(\dfrac{\sigma}{\sigma_{\bar{x}}}\right)^2$

(6 points : 10 minutes)

2. **Construction workers (in the old days) would light a length of "fuse" on fire which would burn toward dynamite and explode it. For fuses cut to ten meters in length, the times between lighting the fuses and the subsequent explosions average 3.5 minutes with a standard deviation of 0.25 minutes (for fuse material from the old supplier).**

   Fuse material from a new supplier arrives at your construction site. To test the behavior of this material, you randomly select 50 sections, each 10 meters long and record how long they burn. For your sample, the mean burn time is 3.16 minutes with a sample standard deviation of 0.48 minutes.

   (a) **Use the sample results to construct a 95% confidence interval for the true mean burn time of all possible 10 meter lengths of ~~your~~ the new fuse material.**

   (b) **Based on your confidence interval, is it reasonable for the new supplier of fuse material to claim that the mean burn time of their material is the same** as **the mean burn time for material from the old supplier?**

Regular: $X \sim (\mu = 3.5, \sigma = 0.25)$

New: $\bar{x} = 3.16$, $s = 0.48$, $n = 50$, $df = 49$

$t_{\alpha/2} = 2.009$ for 50 df.

$$95\%\, CI(\mu) = \bar{x} \pm t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$$

$$= 3.16 \pm 2.009\left(\frac{0.48}{\sqrt{50}}\right)$$

$$= 3.16 \pm 0.14$$

(a) $= [3.02 < \mu < 3.30]$

(b) No. the old $\mu = 3.5$ which is Not in the CI, the reasonable range

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(8 points : 15 minutes)

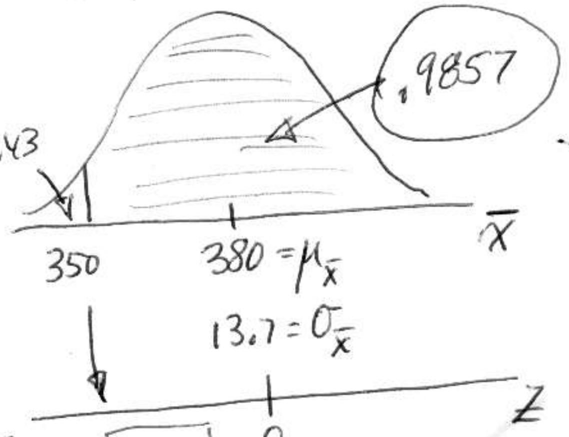
3. **A geologist is searching for mineral deposits that are rich enough to be mined profitably. One area is especially promising, because the average mineral content is 380 grams of mineral for every cubic meter of earth. The standard deviation of the mineral content per cubic meter is 96 grams.**

   Of course, the mining company does not know the "truth" about the mineral content of the area. The company will take samples and will start mining operations if the average mineral content in the samples is greater than 350 grams. If 49 samples of earth (each one cubic meter) are randomly selected, what is the probability that the company will begin mining operations?

Truth $X \sim (\mu = 380, \sigma = 96)$

For $n=49$, $\bar{X} \sim N\left(\mu_{\bar{x}} = 380, \sigma_{\bar{x}} = \frac{96}{\sqrt{49}} = 13.7\right)$

Distribution of all possible $\bar{x}$ when $n=49$



$P(\bar{x} > 350) = P(\text{begin mining})$
$= 0.9857$

area to the right of -2.19

	.09
+2.1	$\boxed{.9857}$

$\frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{350 - 380}{13.7} = Z = \boxed{-2.19}$

4. **The random variable "X" has a distribution with a mean of 62.34 and a standard deviation of 16.77. Consider the distribution of all possible sample means from samples of size 8. Determine the 59th percentile of this sampling distribution.**
   (Hint: You have not seen this type of problem in class or in the textbook. Work from what you) know to what you do not know. Finally, solve for the requested percentile of the "sampling distribution, not the original distribution of "X".)

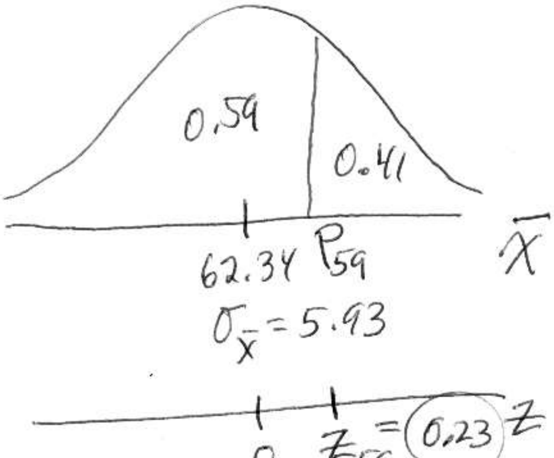
$X \sim (\mu = 62.34, \sigma = 16.77)$

For $n=8$ $\bar{X} \sim N\left(\mu_{\bar{x}} = 62.34, \sigma_{\bar{x}} = \frac{16.77}{\sqrt{8}} = 5.93\right)$

$$\boxed{P_{59} = Z_{59}(\sigma_{\bar{x}}) + \mu_{\bar{x}}}$$

$= (0.23)(5.93) + 62.34$

$= 63.70$



	.03
	$\boxed{.59}$
0.2	$\boxed{.5910}$