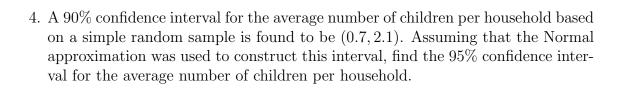NAME: ....

MATH E-156 MATHEMATICAL STATISTICS

ASSIGNMENT 10

1. How would you respond to a friend who asks you, "How can we say that the sample mean is a random variable when it is just a number, like the population mean? For example, a simple random sample of size $n = 140$ produces $\bar{X} = 93.4$; how can the number 93.4 be a random variable?"

2. A lab assistant claims that she uses 90% confidence intervals for the proportion p of necrotic Annexin V-/PI+ cells.

   (a) In 150 different experiments, how many intervals will not include (i.e. will miss) the true proportion p, on average?

   (b) If she wants to use 99% confidence intervals now, does she need to report shorter or longer intervals?

3. Suppose that two populations have equal population variances but are of different sizes: $N_1 = 100,000$ and $N_2 = 10,000,000$. Assuming simple random sampling (SRS), compare the variances of the sample means for a sample of size $n = 25$. Is it substantially easier to estimate the mean of the smaller population?

4. A 90% confidence interval for the average number of children per household based on a simple random sample is found to be $(0.7, 2.1)$. Assuming that the Normal approximation was used to construct this interval, find the 95% confidence interval for the average number of children per household.

5. Suppose that a simple random sample (SRS) is used to estimate the proportion of families of a large population that are living below the poverty level. If this proportion is roughly 0.15, what sample size is necessary so that the standard error of the estimate is approximately 0.02?

6. In a simple random sample of $n = 1,500$ voters, 55% said they planned to vote for a particular proposition, and 45% said they planned to vote against it. The estimated margin of victory for the proposition is thus 10%. What is the standard error of this estimated margin? What is an approximate 95% confidence interval for the margin?

7. From independent surveys of two populations, $(1 - \alpha)100\%$ confidence intervals for the population means are constructed. What is the probability that

(a) both intervals contain the respective population means?

(b) neither interval contains the respective population mean?

8. Suppose that a population of fish has normally distributed length X inches with the mean μ and the standard deviation σ. In each case below, find μ and σ if we know that

(a) $\sigma = 4$ inches and $P(X \leq 23) = 0.02$

(b) $\sigma = 6$ inches and $P(X > 25) = 0.93$

(c) $P(X \leq 90) = 0.30$ and $P(X \leq 130) = 0.93$