Practice problems for Midterm 2

(1) A variable of a population has a mean $\mu = 250$ and standard deviation $\sigma = 21$. A sample of size 49 is taken from the population. What is the approximate probability that the sample mean is less than 245?

(2) Suppose a certain population is Normal with unknown mean μ and standard deviation $\sigma = 10$. A sample of size 100 is taken from the population and the sample mean is $\bar{x} = 33.5$. Find a 90% confidence interval for μ.

(3) The standard IQ test is designed so that standard deviation is 20 for the population of all adults. We wish to find the sample size necessary to estimate the mean IQ score. Suppose we want to be 95% confident that our sample mean is within 2 IQ points of the true mean. Determine the required sample size.

(4) We know that a certain population has a Normal distribution with unknown mean μ and standard deviation $\sigma = 12$. We are interested in testing $H_0 : \mu = 55$ versus $H_a : \mu < 55$ with a significance level $\alpha = 0.05$. Suppose we decide to choose a sample of size $n = 92$ from the population. For what values of $\bar{x}$ would we reject the null hypothesis?

Suppose that the sample we chose has a sample mean of $\bar{x} = 54$. What is the value of the standardized test statistic? What is the p-value for our test? Would we reject H_0 with $\alpha = 0.05$?

Suppose now that the population mean is 50. What is the power of our test?

(5) The following random sample was selected from a normal distribution

$$8,\ 10,\ 11,\ 4,\ 5$$

Find a 95% confidence interval for the population mean μ.

(6) One of the most feared predators in the ocean is the great white shark. It is known that the white shark grows to a mean length of 22 feet; however, one marine biologist believes that great white sharks off the Bermuda coast grow much longer. To test this claim, full-grown white sharks were captured, measured, and then set free. However, this was a difficult, costly and very dangerous task, so only four sharks were actually sampled. Their lengths were 24, 20,21 and 21 feet. Do the data provide sufficient evidence to support the claim? Use $\alpha = 0.01$.

(7) The data below are samples from two populations. Find a 95% confidence interval for the difference of the two means.

	n	$\bar{x}$	std. dev.
Sample 1	10	12	2
Sample 2	15	18	1

(8) The aim of this study is to determine if education programs for preschool children that follow the "Montessori method" perform better than the other education programs. The study compared 5-year-old children in Milwaukee, Wisconsin who had been enrolled in preschool programs from the age of 3. Here are the data on the scores on a test of ability to apply basic mathematics to solve problems.

Montessori method: $n = 30,\ \bar{x} = 19,\ s = 3.11$

Other method: $n = 25,\ \bar{x} = 17,\ s = 4.19$

Is there evidence of a difference in the population mean scores for these two methods? Describe your test, explain all your steps and state your conclusion precisely. You might use a significance level of $\alpha = 0.05$.

(9) The data below are samples from two populations. Test the claim that the mean of the first population is larger than the mean of the second population. Assume that the samples are independent simple random samples. Use a significance level of 0.05.

	n	$\bar{x}$	std. dev.
Sample 1	82	12	2
Sample 2	54	18	1