Math 4441: Probability and Statistics

Tutorial Class (4/5)

1.	An instructor knows from past experience that student exam scores have mean 77 and standard deviation 15. At present the instructor is teaching two separate classes – one of size 25 and the other of size 64.	
	a)	Approximate the probability that the average test score in the class of size 25 lies between 72 and 82.
	b)	Repeat part (a) for a class of size 64.
	c)	Find out the approximate probability that the average test score in the class of size 25 is higher than that of the class size 64.
	d)	Suppose the average scores in the two classes are 76 and 83. Which class, the one of size 25 or the one of size 64, do you think was more likely to have average 83?
		(a) $\Phi(25/15) - \Phi(-25/15) = .9044$ (b) $\Phi(40/15) - \Phi(-40/15) = .9924$ (c) 1/2, since the amount by which the average score of the smaller exceeds tha the larger is a normal random variable with mean 0. (d) the smaller one
2.	Construct a 95% confidence interval for the population mean based on a sample of measurements	
	2.5, 7.4, 8.0, 4.5, 7.4, 9.2	
	if measurement errors have Normal distribution, and the measurement device guarantees a standard deviation of $\sigma = 2.2$.	
3.	A manager evaluates effectiveness of a major hardware upgrade by running a certain process 50 times before the upgrade and 50 times after it. Based on these data, the average running time is 8.5 minutes before the upgrade, 7.2 minutes after it. Historically, the standard deviation has been 1.8 minutes, and presumably it has not changed. Construct a 90% confidence interval showing how much the mean running time reduced due to the hardware upgrade.	
4.	A bakery was taken to court for selling loaves of bread that were under-weight. These loaves were advertised as weighing 24 ounces. In its defense, the bakery claimed that the advertised weight was meant to imply not that each loaf weighted exactly 24 ounces, but rather that average value over all loaves was 24 ounces. The prosecution in a rebuttal produced evidence that a randomly chosen sample of 20 loaves had an average weight of 22.8 ounces with a sample standard deviation of 1.4 ounces. In her ruling, the judge stated that advertising a weight of 24 ounces would be acceptable if the mean weight were at least 23 ounces.	
	a)	State the null and alternate hypothesis to be tested for the claim.

	b)	For the 5 percent level of significance, what should be the judge rule?
	c)	Find the p-value of the hypothesis testing.
5.	If $X1, \ldots, Xn$ is a sample from a normal population having known mean μ_1 and unknown variance σ_1^2, and Y1, . . . , Ym is an independent sample from a normal population having known mean μ_2 and unknown variance σ_2^2 , determine a 100(1 − α) percent confidence interval for σ_1^2/σ_2^2.	
6.	A question of medical importance is whether jogging leads to a reduction in one's pulse rate. To test this hypothesis, 8 nonjogging volunteers agreed to begin a 1-month jogging program. After the month their pulse rates were determined and compared with their earlier values. If the data are as follows, can we conclude that jogging has had an effect on the pulse rates?	

Subject	1	2	3	4	5	6	7	8
Pulse Rate Before	74	86	98	102	78	84	79	70
Pulse Rate After	70	85	90	110	71	80	69	74

7.	The following table relates the number of sunspots that appeared each year from 1970 to 1983 to the number of auto accident deaths during that year. Test the hypothesis that the number of auto deaths is not affected by the number of sunspots. (The sunspot data are from Jastrow and Thompson, *Fundamentals and Frontiers of Astronomy,* and the auto death data are from *General Statistics of the U.S. 1985.*)	