Math 121   **Test #3**   **Fall 2008**

1. (15 pts) A new weight-loss plan is introduced. The old weight-loss plan produced an average weight loss of 4.2 lbs at the end of the first month. The new plan was tested on a sample of 36 subjects. They experienced an average weight loss of 4.8 lbs in the first month, with a standard deviation of 1.5 lbs. Test the hypothesis that the new weight-loss plan is better than the old plan using a 5% significance level. That is, test the hypothesis that it produces an average weight loss of more than 4.2 lbs in the first month.

2. (8 pts) Use the statistics of the previous problem to find a 95% confidence interval estimating the average weight loss after one month under the new plan.

3. (15 pts) Seat belt use in the U.S. was at 81% in 2006. It may be lower in Virginia. Suppose that a sample of 521 Virginia drivers found that 410 of them are wearing their seat belts. Test the hypothesis at the 5% level of significance that seat belt use in Virginia is less than the national rate of 81%.

4. (12 pts) Using the statistics of the previous problem,

   (a) (8 pts) Find a 90% confidence interval for the proportion of Virginia drivers who use their seat belts.

   (b) (4 pts) Find the margin of error in your confidence interval in part (a).

5. (8 pts) Find the following probabilities for the t distribution with the given number of degrees of freedom.

   (a) $P(t > 2.5)$ with $df = 6$.

   (b) $P(-1 < t < 1)$ with $df = 10$.

6. (6 pts) For each of the following research questions, tell whether it would be better to study it using paired samples or independent samples. Explain your answers briefly.

   (a) Are men are more likely than women to vote Republican?

   (b) Do students who score higher on the SAT math test generally also score higher on the SAT verbal test?

7. (15 pts) Studies have shown that in localities where concealed-carry permits are introduced (permits to carry concealed weapons), violent crime drops. However, non-violent crime, such as burglary, sometimes rise. The theory is that criminals substitute less risky non-confrontational crimes for the riskier confrontational crimes once the intended victims are permitted to carry concealed weapons.

   A district that implemented a concealed-carry law found that there were 52 non-violent crimes out of 168 total crimes during the six months prior to the new law and there were 55 non-violent crimes out of 145 total crimes during the six

months after the new law. Of course, the increase in the non-violent crime rate could have been due to randomness, or it could signify a new trend. Test the hypothesis that the non-violent crime rate is higher after the implementation of the concealed-carry law, using a 1% significance level. (The non-violent crime rate is the proportion of crimes that are non-violent.) Be sure to specify which population is Population #1 and which is Population #2.

8. (21 pts) Today is pretty cold. The predicted high for today is only $40°$. The following tables shows the high temperatures in Farmville for Nov 21 for the years 1988 - 1997 and 1998 - 2007. Consider the two groups to be independent samples of size 10.

Year	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97
High temp.	64	68	65	74	45	55	63	59	43	53

Year	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07
High temp.	53	73	42	53	59	73	64	50	44	75

(a) (3 pts) Create a QQ plot of each sample and tell whether it indicates that the populations are normal.

(b) (15 pts) The two samples have means that are surprisingly close together. Nevertheless, test the hypothesis that the average high temperature for Nov 21 has changed from the years 1988 - 1997 to the years 1998 - 2007. Use $\alpha = 0.01$. Be sure to specify which population is Population #1 and which is Population #2.

(c) (3 pts) What are the two sample standard deviations and the pooled estimate of σ?