Homework 8

1. You want to see if a redesign of the cover of a mail-order catalog will increase sales. A very large number of customers will receive the original catalog, and a random sample of customers will receive the one with the new cover. For planning purposes, you are willing to assume that the sales from the new catalog will be approximately Normal with $\sigma = 50$ dollars and that the mean for the original catalog will be $\mu = 25$ dollars. You decide to use a sample size of $n = 900$. You wish to test

$$H_0 : \mu = 25 \quad \text{versus} \quad H_0 : \mu > 25.$$

You decide to reject H_0 if $\bar{X} > 26$.

(a) Find the probability of a Type I error, that is, the probability that your test rejects H0 when in fact $\mu = 25$ dollars. （先給拒絕原則，再問型一錯誤）
(b) Find the probability of a Type II error when $\mu = 28$ dollars. This is the probability that your test accepts H_0 when in fact $\mu = 28$.

(c) Find the probability of a Type II error when $\mu = 30$. What is the power when $\mu = 30$.

2. The investigation described in (1) is conducted again. You wish to test

$$H_0 : \mu = 25 \quad \text{versus} \quad H_0 : \mu > 25$$

under 5% level of significance. Set the sample size as n and assume that $\sigma = 50$ is known.
a. Please state the rejection rule.

b. Please find the smallest sample size such that the power at $\mu = 28$ is at least 0.9.

3. A recent study at Baylor University investigated the lipid levels in a cohort of sedentary university students. A total of 108 students volunteered for the study and met the eligibility criteria. The following table summarizes the blood lipid levels, in milligrams per deciliter (mg/dl), of the participants broken down by gender:

	Females ($n = 71$)		Males ($n = 37$)	
	$\bar{x}$	s	$\bar{x}$	s
Total cholesterol	173.70	34.79	171.81	33.24
LDL	96.38	29.78	109.44	31.05
HDL	61.62	13.75	46.47	7.94

(a) Describe appropriate null and alternative hypotheses for comparing male and female **total cholesterol levels under the assumption that the variances are equal**. Carry out the significance test. Report the test statistic with the degrees of freedom and the P-value. Find a 95% confidence interval for the difference between the two means. Compare the information given by the interval with the information given by the significance test.

(b). LDL is known as "bad" cholesterol. Suppose the researchers wanted to **test the hypothesis that LDL levels are higher in sedentary males than in sedentary females.** Assume that the variances may not be identical. Describe appropriate null and alternative hypotheses and, based on the conservative principle, carry out the significance test using $\alpha = 0.05$.

4.

a. In a 2004 survey of 1200 undergraduate students throughout the United States, 89% of the respondents said they owned a cell phone.5 For 90% confidence, what is the margin of error?

b. It was reported that cell phone ownership by undergraduate students in 2003 (from 1200 undergraduate students taking the survey) was 83%. Do the sample data in 2004 give good evidence that this percent has increased?

Give the null and alternative hypotheses. Carry out the significance test. Report the test statistic and the P-value. State your conclusion using $\alpha = 0.05$.

c. Given that the sample size of each SRS is 1200 students, compare these two years with a significance test, and give an estimate of the difference in proportions of undergraduate cell phone owners with a 95% margin of error.