NAME:____

Practice Exam 2 for STA321 Spring 2014,

FORMULA:

Variance:

$$s^2 = \frac{\sum (Y_i - \overline{Y})^2}{n-1} \quad \sigma^2 = \frac{\sum (Y_i - \mu)^2}{N}$$

Standard Deviation

$$s = \sqrt{\frac{\sum (Y_i - \overline{Y})^2}{n-1}} \quad \sigma = \sqrt{\frac{\sum (Y_i - \mu)^2}{N}}$$

Risk difference $\frac{a}{a+b} - \frac{c}{c+d}$

Relative Risk $\frac{a}{a+b} / \frac{c}{c+d}$

Odd Ratio $\frac{a}{b} / \frac{c}{d}$

Sample covariance

$$s_{xy} = \frac{\sum (x_i - \overline{x})(y_i - \overline{y})}{n-1} = \frac{1}{n-1}\left(\sum x_i y_i - \frac{1}{n} \sum x_i \sum y_i \right)$$

Sample correlation coefficient

$$r = \frac{s_{xy}}{s_x s_y}$$

Least Square Equation

$$\hat{y} = b_0 + b_1 \cdot x$$

slope $$b_1 = \frac{s_{xy}}{s_x^{\;2}} = \frac{\sum_i (x_i - \bar{x}) \cdot (y_i - \bar{y})}{\sum_i (x_i - \bar{x})^2}$$

intercept $$b_0 = \bar{y} - b_1 \cdot \bar{x}$$

Problem 1 multiple choices

____ 1. The standard deviation of the sampling distribution of $\overline{X}$ is also called the:
a. central limit theorem.
b. standard error of the sample mean.
c. finite population correction factor.
d. population standard deviation.

____ 2 Random samples of size 49 are taken from an infinite population whose mean is 300 and standard deviation is 21. The mean and standard error of the sample mean, respectively, are:
a. 300 and 21
b. 300 and 3
c. 300 and 0.43
d. None of these choices.

____ 3. If all possible samples of size *n* are drawn from an infinite population with a mean of 15 and a standard deviation of 5, then the standard error of the sample mean equals 1.0 for samples of size:
a. 5
b. 15
c. 25
d. None of these choices.

____ 4. The Central Limit Theorem states that, if a random sample of size *n* is drawn from a population, then the sampling distribution of the sample mean $\overline{X}$:
a. is approximately normal if $n > 30$.
b. is approximately normal if $n < 30$.
c. is approximately normal if the underlying population is normal.
d. None of these choices.

____ 5 The standard error of the sample proportion gets larger as:
a. p approaches 0
b. p approaches 0.50
c. p approaches 1.00
d. None of these choices.

____ 6. Which of the following conclusions is not an appropriate conclusion from a hypothesis test?

a. Reject H_0. Sufficient evidence to support H_1.
b. Fail to reject H_0. Insufficient evidence to support H_1.
c. Accept H_0. Sufficient evidence to support H_0.
d. All of these choices are true.

____ 7. A Type II error is committed if we make:
a. a correct decision when the null hypothesis is false.
b. a correct decision when the null hypothesis is true.
c. an incorrect decision when the null hypothesis is false.
d. an incorrect decision when the null hypothesis is true.

____ 8. The probability of a Type II error is denoted by:
a. α
b. β
c. $1 - \alpha$
d. $1 - \beta$

____ 9. If we reject the null hypothesis when it is false, then we have committed:
a. a Type II error.
b. a Type I error.
c. both a Type I error and a Type II error.
d. neither a Type I error nor a Type II error.

____ 10. The owner of a local nightclub has recently surveyed a random sample of n = 300 customers of the club. She would now like to determine whether or not the mean age of her customers is over 35. If so, she plans to alter the entertainment to appeal to an older crowd. If not, no entertainment changes will be made. The appropriate hypotheses to test are:
a. H_0: $\mu = 35$ vs. H_1: $\mu < 35$.
b. H_0: $\mu = 35$ vs. H_1: $\mu > 35$.
c. H_0: $\overline{X} = 35$ vs. H_1: $\overline{X} < 35$.
d. H_0: $\overline{X} = 35$ vs. H_1: $\overline{X} > 35$.

Problem 2

Al Gore, the former Vice President of the United States, believes that the proportion of voters who will vote for John Kerry in the year 2004 presidential elections is 0.65. A sample of 500 voters is selected at random.

(a) Assume that Gore is correct and $p = 0.65$. What is the sampling distribution of the sample proportion $\hat{P}$?

(b) Set up the null and alternative hypotheses for testing Gore's claim.

(c) In the sample, 267 people voted for Kerry. Set up the 95% confidence interval for the hypotheses. Then decide whether you reject the null hypothesis or not.

(d) How large a sample size would we need to achieve a margin of error of plus minus 1 percentage point?

(e) How large a random sample would we need if we wanted to achieve 90% power at a true alternative of $\hat{P}$= 0.45, while maintaining alpha = 0.05?

Problem 3

Suppose that the starting salaries of female math professors have a positively skewed distribution with mean of $56,000 and a standard deviation of $12,000. The starting salaries of male math professors are positively skewed with a mean of $50,000 and a standard deviation of $10,000. A random sample of 50 female math professors and a random sample of 40 male math professors are selected.

a. {Professors' Salary Narrative} What is the sampling distribution of the sample mean difference $\overline{X}_1 - \overline{X}_2$? Explain.

b. {Professors' Salary Narrative} Find the standard error of the sample mean difference.

Problem 4

A researcher claims athletes spend an average of 40 minutes per day watching sports. You think the average is higher than that. In testing your hypotheses H_0: $\mu = 40$ vs. H_1: $\mu > 40$, the following information came from your random sample of athletes: $\overline{X} = 42$ minutes, $n = 25$. Assume $\sigma = 5.5$, and $\alpha = 0.10$.

a. {Watching Sports Narrative} Set up the rejection region.

b. {Watching Sports Narrative} Interpret the result.

Problem 5

A researcher wants to study the average miles run per day for runners. In testing the hypotheses: H_0: $\mu = 25$ miles vs. H_1: $\mu \neq 25$ miles, a random sample of 36 runners drawn from a normal population whose standard deviation is 10, produced a mean of 22.8 miles weekly.

a. {Runners Narrative} Compute the value of the test statistic and specify the rejection region associated with 5% significance level.

b. {Runners Narrative} Develop a 95% confidence interval estimate of the population mean.

c. {Runners Narrative} Explain briefly how to use the confidence interval to test the hypothesis.

Problem 6

Thirty-five employees who completed two years of college were asked to take a basic mathematics test. The mean and standard deviation of their scores were 75.1 and 12.8, respectively. In a random sample of 50 employees who only completed high school, the mean and standard deviation of the test scores were 72.1 and 14.6, respectively.

{Employees Test Scores Narrative} Estimate with 90% confidence the difference in mean scores between the two groups of employees.

Problem 7

To compare the wearing of two types of automobile tires, 1 and 2, an experimenter chose to "pair" the measurements, comparing the wear for the two types of tires on each of 7 automobiles, as shown below.

Automobile	1	2	3	4	5	6	7
Tire 1	8	15	7	9	10	13	11
Tire 2	12	18	8	9	12	11	10

{Auto Tires Wear Narrative} Estimate with 90% confidence the mean difference and interpret.