

## Review of Basic Statistical Concepts Self-Assessment Exam

1. (10 points)

On July 8th, 2004, the U.S. Census Bureau reported on their "population clock" that the population of the United States was 293,683,456 people. The National Endowment of the Arts conducted a survey — titled "Reading at Risk" — on the reading habits of approximately 17,000 adults. Of those surveyed, only 57% read a book in 2002.

- What is the population under investigation?
- What is the parameter of interest?
- What is the sample?
- What is the sample statistic?

2. (10 points)

Most — if not all — statistical software have  $t$ -distribution probability calculators that allow you to determine the appropriate  $t$ -multiplier when finding a confidence interval for a population mean  $\mu$ . It entails telling the software the cumulative probability — that is, the probability to the left of the  $t$ -multiplier — and the degrees of freedom. Use Minitab to determine the appropriate  $t$ -multiplier for calculating a confidence interval for a population mean  $\mu$  in the following situations.

- For a 95% confidence interval based on a sample size of  $n = 15$ .
- For a 95% confidence interval based on a sample size of  $n = 26$ .
- For a 91% confidence interval based on a sample size of  $n = 15$ .

3. (10 points)

In order to monitor the weight changes in a herd of calves, six randomly chosen calves were weighed initially, individually identified with ear tags, and then weighed again one month later. The resulting data were analyzed in Minitab:

One-Sample T: Change					
Variable	N	Mean	StDev	SE Mean	95% CI
Change	6	-8.000	2.82843	1.15470	(-10.968, -5.032)

- a) Use the reported sample mean and sample standard deviation, Minitab's  $t$ -distribution calculator and the formula for the confidence interval for a population mean  $\mu$  to verify the confidence interval reported by Minitab.
- b) Interpret the interval.

4. (10 points)

The Center for Disease Control had determined that the mean weight of all eleven-year old Caucasian boys is 88 pounds. A complaint is made that 25 such boys living in a county children's home are underfed. As one piece of evidence, the boys weighed an average of 83 pounds with a standard deviation of 10 pounds.

- a) State an appropriate null and alternative hypothesis for this situation.
- b) Choose an appropriate significance level  $\alpha$  for this situation.
- c) Perform the appropriate hypothesis test using the critical value approach. In doing so, use Minitab's  $t$ -distribution calculator to find the critical value.
- d) Perform the appropriate hypothesis test using the  $P$ -value approach. In doing so, use Minitab's  $t$ -distribution calculator to find the  $P$ -value.

5. (10 points)

Suppose a random sample of 216 patients that have a skin disease are classified into the four age categories. The frequencies are summarized in the following table:

		Age category				Total
		1	2	3	4	
Severity	Moderate	15	32	18	5	70
	Mildly severe	8	29	23	18	78
	severe	1	20	25	22	68
Total		24	81	66	45	216

Conduct a test to determine if the severity of the disease is independent of the age of the patient.

6. (10 points)

Suppose the Pennsylvania population is 55% female and 45% male. Then, if a sample of 100 persons yields 53 females and 47 males, can we conclude that the sample is (random and) representative of the population?

7. (10 points)

Let  $X$  denote the weight loss of women after taking an exercise program. Assume that  $X$  is normally distributed with unknown mean  $\mu$  and standard deviation 4. Weight loss of 14 women are recorded. To see if the women do lose their weight, we can test the null hypothesis  $H_0: \mu = 0$  against the alternative hypothesis that  $H_A: \mu > 0$ .

What is the power of the hypothesis test if the true population mean were  $\mu = 5$ ? ( $\alpha=0.05$ )

8. (10 points)

In Problem 7, Find the sample size  $n$  that is necessary to achieve 0.90 power at the alternative  $\mu = 5$ .

9. (10 points)

One of the largest problems on college campuses is alcohol abuse by underage students. Universities are acutely aware of the problem of binge drinking, defined as consuming five or more drinks in a row three or more times in a two-week period. An extensive survey of college students reported that 44% of U.S. college students engaged in binge drinking during the two weeks before the survey. The president of a university stated publicly that binge drinking was not a problem on her campus of 25000 undergraduate students. A survey was conducted on 2500 undergraduate students attending the university. The survey showed that 1200 of the 2500 students had engaged in binge drinking. Is there sufficient evidence to indicate that the percentage of students engaging in binge drinking at the university is greater than the percentage found in national survey? (Use Critical Value Approach,  $\alpha=0.05$ )

10. (10 points)

A sample survey funded by National Science Foundation asked a random sample of American adults about biological evolution. One question asked subjects to answer “True” or “False” to the statement “Human beings, as we know them today, developed from earlier species of animals .” Of the 1484 respondents, 713 said “True”. Does the sample give good evidence to support the claim “ Larger than half of American adults think that humans developed from earlier species of animals”? ( Use  $p$ -value Approach,  $\alpha=0.05$ )