22S:30/105, Statistical Methods and Computing
PRACTICE PROBLEMS for MIDTERM 2
Spring 2005, Instructor: Cowles
Midterm 2

Show your work on any problems that involve calculations.

There are 26 total points on this midterm. Point values for each question are shown in parentheses. I will grade on a curve and will give partial credit wherever possible.

`Name: ________________________________________ Course no. (30 or 105) _____`

1. (3) You wish to estimate the population mean IQ test score of seventh-grade girls in the Iowa City/Coralville school district. Suppose that the standard deviation of IQ scores in this population is known to be $\sigma = 15$ points. How large a sample of seventh-grade girls would you need to estimate the population mean IQ score μ within $\pm$ 5 points with 90% confidence?

2. Percentages of ideal body weight were determined for 18 randomly selected insulin-dependent diabetics. A percentage of 120 means that an individual weighs 20% more than his or her ideal body weight, while a percentage of 100 means that an individual weighs exactly his or her ideal body weight. (Data from Pagano and Gauvreau, Principles of Biostatistics, 2nd edition, p. 229.) Here is a listing of the data:

Obs	bwgtpct
1	107
2	119
3	99
4	114
5	120
6	104
7	88
8	114
9	124
10	116
11	101
12	121
13	152
14	100
15	125
16	114
17	95
18	117

We wish to use these data to test the null hypothesis that, in the population of all insulin-dependent diabetics, the mean percentage of ideal body weight is 100%. We do not know in advance whether to expect the population mean to be larger or smaller than 100%.

(a) (2) Write the null and alternative hypotheses, using conventional symbols.

(b) (1) This is a (circle one):
  i. one-sided test
  ii. two-sided test
  iii. Chi square test
  iv. none of the above

(c) (1) This study is set up as a (circle one):
  i. one-sample problem
  ii. paired-sample problem
  iii. two-idependent-sample problem
  iv. impossible to tell from the description given
  v. none of the above

(d) (1) We wish to conduct our hypothesis test at significance level $\alpha = .01$. This means that (circle one):
  i. We wish to have only a .01 chance of failing to reject H_0 if H_0 is false.
  ii. We wish to have only a .01 chance of rejecting H_0 if H_0 is false.
  iii. We wish to have only a .01 chance of failing to reject H_0 if H_0 is true .
  iv. We wish to have only a .01 chance of rejecting H_0 if H_0 is true.
  v. None of the above.

(e) (1) The data is used to compute a 99% t confidence interval. The SAS output is:

```
                    Analysis Variable : bwgtpct

                                                Lower 99%       Upper 99%
 N           Mean          Std Dev            CL for Mean     CL for Mean
-------------------------------------------------------------------------
18     112.7777778       14.4244709         102.9241407     122.6314149
-------------------------------------------------------------------------
```

What quantity are we 99% confident lies in the interval (102.92, 122.63)? (circle one):

i. The sample mean of percent of ideal body weight from the 18 diabetics in the study.
ii. The population mean of percent of ideal body weight in all insulin-dependent diabetics.
iii. The mean difference between ideal body weight and actual body weight.
iv. None of the above.

(f) (2) Based on the confidence interval, the correct decision regarding the hypothesis test is (circle one) :

i. reject H_0 at the .01 significance level
ii. fail to reject H_0 at the .01 significance level
iii. impossible to draw a conclusion from the confidence interval
iv. none of the above

(g) (2) Write one assumption required for the use of t-tests and t confidence intervals.

(h) (2) What would you do to verify whether the assumption you listed in the previous question is met for this problem?

3. A researcher wishes to investigate whether the mean resting heart rate in the population of undergraduate students at UI is greater than 75 beats per minute. He states the hypotheses for his statistical test as:

$$H_0: \quad \mu \leq 75$$
$$H_A: \quad \mu > 75$$

He is convinced that resting heart rates in the population follow an approximately normal distribution with known standard deviation $\sigma = 8$. He measures the resting heart rate on a simple random sample of 25 UI undergrads.

(a) (1) Will large values of $\bar{x}$ or small values of $\bar{x}$ enable him to reject H_0? (large/small)

(b) (3) What is the sampling distribution of $\bar{x}$ if the null hypothesis is true? Give the following:

- the name of the distribution
- the mean (numeric value)
- the standard deviation (numeric value)

(c) (3) The researcher chooses to conduct his hypothesis test at significance level $\alpha = .05$. What is the cut-off value of $\bar{x}$ that would enable him to reject H_0? Give a numeric answer. Show your calculations.

(d) (3) What is the power of the test against the alternative $\mu = 77$? Give a numeric answer. Show your calculations.

(e) (1) *Power* in a statistical test is (circle one):

i. The probability of rejecting H_0 given that H_0 is true.
ii. The probability of rejecting H_0 given that H_0 is false.
iii. The probability of failing to reject H_0 given that H_0 is true.
iv. The probability of failing to reject H_0 given that H_0 is false.
v. None of the above.