Due by 4pm on Friday, February 14. Please leave your homework on the table before class begins on Friday or leave it in the dropbox outside my office. Do not forget to attach the honor code. Each problem is worth 20 points.

(1) Suppose  $Y_1, Y_2, \ldots, Y_n$  constitute a random sample from a uniform distribution with probability density function

$$f(y|\theta) = \begin{cases} \frac{1}{2\theta+1} & 0 \le y \le 2\theta+1\\ 0 & \text{otherwise} \end{cases}$$

- (a) Obtain the MLE of  $\theta$ .
- (b) Obtain the MLE for the *variance* of the underlying distribution.
- (2) An experimenter has prepared a drug dosage level that she claims will induce sleep for 80% of people suffering from insomnia. After examining the dosage, we feel that her claims regarding the effectiveness of the dosage are inflated. In an attempt to disprove her claim, we administer her prescribed dosage to 20 insomniacs and we observe Y, the number for whom the drug dose induces sleep. We wish to test the hypothesis  $H_0: p = .8$  versus the alternative,  $H_a: p < .8$ . Assume that the rejection region  $\{y \le 12\}$  is used.
  - (a) In terms of this problem, what is a type I error?
  - (b) Find  $\alpha$ .
  - (c) In terms of this problem, what is a type II error?
  - (d) Find  $\beta$  when p = .6.
- (3) A study by Children's Hospital in Boston indicates that about 67% of American adults and about 15% of children and adolescents are overweight. Thirteen children in a random sample of size 100 were found to be overweight. Is there sufficient evidence to indicate that the percentage reported by Children's Hospital is too high? Test at the  $\alpha = 0.05$  level of significance.
- (4) The output voltage for an electric circuit is specified to be 130. A sample of 40 independent readings on the voltage for this circuit gave a sample mean 128.6 and standard deviation 2.1. Test the hypothesis that the average output voltage is 130 against the alternative that it is less than 130. Use a test with level .05.
- (5) Shear strength measurements derived from unconfined compression tests for two types of soils gave the results shown in the following table (measurements in tons per square foot). Do the soils appear to differ with respect to average shear strength, at the 1% significance level?

Soil Type I	Soil Type II
$n_1 = 30$	$n_2 = 35$
$\overline{y}_1 = 1.65$	$\overline{y}_2 = 1.43$
$s_1 = 0.26$	$s_2 = 0.22$