Economics 250 Midterm Test 2: Answer Guide

1. (a) This is a binomial problem with $n = 10$ and $P = 0.4$. From table 3 the probability of 3 or fewer seats is 0.382 so the probability of 4 or more is 61.8%. Similarly, the probability of 5 or more seats is 36.7%.

(b) With $n = 100$ we use the normal approximation to the binomial density: $x \sim N(40, 24)$. You can see that the mean is 40 so the probability of 40 or more seats is 0.5. As for 50 or more seats, standardizing gives:

$$z = \frac{50 - 40}{4.8989} = 2.04.$$

From table 1, there is 2.07% probability of 50 or more seats.

2. (a) The probability of a positive test is 1/5 or 0.20.

(b) The probability of a positive test is 5/6 or 0.833.

(c) The joint probability of taking the drug and testing positive is the product of the conditional and marginal probabilities: $0.10(0.833) = 0.0833$. The marginal probability of testing positive is $0.0833 + 0.2(0.9) = 0.2633$. So the probability of taking the drug conditional on a positive test is $0.0833/0.2633 = 0.316 = 31.6\%$.

3. (a) The 95% confidence interval is:

$$0.5 \pm 1.96\sqrt{0.5)(0.5)/100} = 0.5 \pm 0.098 = (0.402, 0.598)$$

(b) Our test statistic is:

$$z = \frac{0.5 - 0.6}{0.0489} = -2.0449.$$

(Note importantly that we use the value of P under the null to find the standard error.) Table 1 shows the critical value is -1.28 so we reject the null hypothesis. The p-value (from table 1) is 0.02 or 2%. There is only a 2% chance of finding a sample value this low when the null hypothesis is true.

4. (a) The sample mean is $\overline{x} = 154$. The sample standard deviation is $s = 8$. The cutoff points for the t-distribution with 19 df are ± 1.729; that leaves 5% in each tail. Thus the confidence interval is:

$$154 \pm 1.729(8/4.472) = 154 \pm 3.09 = (150.91, 157.09)$$

(b) Our t-statistic is:

$$t = \frac{154 - 158}{1.789} = -2.23.$$

With $df = 19$ the critical values are ± 1.729 with $\alpha = 0.10$. The test statistic is outside these values, so we can reject the null hypothesis.