HW 4

1. Let X be binomial$(20, p)$. Suppose for testing $H : p = 0.3$ against $K : p > 0.3$ we decide to reject the null hypothesis H if and only if $x = 10, 11, \ldots, 20$. For both parts of this question your answer should include both a mathematical expression and a numerical value.

i) Find the probability of making the Type I error with this test.

ii) Find the probability of making the Type II error with this test when $p = 0.6$.

2. Suppose when testing a new treatment on 144 subjects 89 were considered a success. Find a 95% CI for p_1,the true probability of success for this treatment. Suppose in a companion study for a second treatment 67 out 105 resulted in a success. Find the 95% CI for $p_1 - p_2$.

3. A manufacturer claims that at least 40% of the widgets he supplies can be rated as superior. Test this claim in a random sample of 44 yielded 15 superior widgets.

4. A researcher claims that a new and cheaper process will produce the same percentage of widgets that pass inspection as the standard method. Test this claim at $\alpha = 0.05$ if 75 of the 100 widgets produced under the old system passed while 36 out of 50 from the new system passed.

5. A hair growth company claims that for bald men who use their product 25% grow lots of hair, 40% grow some hair and 35% grow no hair. Test their claim at level $\alpha = .01$ if in a random sample of 100 men 20 grew lots of hair, 30 grew some hair and 50 grew no hair.

6. A bakery was concerned about the bacterial count in its cherry and apple pies. They selected 100 pies at random and each was classified as having either a low or high bacterial count. At level $\alpha = .05$ test the hypothesis that the type of pie and bacterial count are independent against the alternative that they are not.

	Low	High
Apple	30	10
Cherry	30	30

7. The following data represents smoking status by level of education for residents of a certain city for adults 30 years or older from a random sample of 200.

	Smoking Status		
Education	Current	Former	Never
$<$ College Degree	40	40	60
$\geq$ College Degree	10	10	40

Test whether smoking status and level of education are independent at the $\alpha = 0.05$ level.

8. A survey was conducted to find out whether a teenager's family status has any relationship to the amount of alcohol he or she consumes. A random

sample of 200 teenagers were questioned about their alcohol use. The results are given in the table below.

	Alcohol		
	None	Occasional	Frequent
Upper Class	4	16	10
Upper Middle Class	11	40	24
Lower Middle Class	9	47	9
Lower Class	6	17	7

i) Do the data provide sufficient evidence to indicate a relationship between family status and the use of alcohol? Test using $\alpha = 0.05$.

ii) What assumptions are necessary to justify the test of part a? Do you think they are satisfied in this application.

9. To see examples of the central limit theorem, in particular for the binomal(n, p) as n gets large even for values of p close to one use the following R command.

```
plot(0:n,dbinom(0:n,n,p),type="h")
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