Assignment #2

Due: **Friday, October 22 at 12pm in the box marked Stat 333 inside room MS 315.**

Assignments will not be accepted if they are passed in after this time.

Assignments must be understandable (logically correct as well as legible).

Marks will be deducted if the assignment does not have a cover page with your name, and pages that are stapled!

1. The genetic origin and properties of maize (modern day corn) was investigated in *Economic Botany* (Jan. - Mar. 1995). Seeds from maize ears carry either single spikelets or paired spikelets, but not both. Progeny tests on approximately 600 maize ears revealed the following information. Forty percent of all seeds carry single spikelets, while 60% carry paired spikelets. A seed with single spikelets will produce maize ears with single spikelets 29% of the time and paired spikelets 71% of the time. A seed with paired spikelets will produce maize ears with single spikelets 26% of the time and paired spikelets 74% of the time.
   (a) Find the probability that a randomly selected maize ear seed carries a single spikelet and produces ears with single spikelets.
   (b) Find the probability that a randomly selected maize ear seed produces ears with paired spikelets.

2. People with albinism have little pigment in their skin, hair and eyes. The gene that governs albinism has two forms (called alleles) which we denote by *a* and *A*. Each person has a pair of these genes, one inherited from each parent. A child inherits one of each parent's two alleles, independently with probability 0.5. Albinism is a recessive trait, so a person is albino only if the inherited pair is *aa*.
   (a) Beth's parents are not albino but she has an albino brother. What are Beth's parent's type and explain why.
   (b) Which of the types *aa*, *Aa*, *AA* could a child of Beth's parents have? What is the probability of each type?
   (c) Beth is not albino. What are the conditional probabilities for Beth's possible genetic types, given this fact?

3. Suppose that in a certain population of married couples 30% of the husbands are overweight, 20% of the wives are overweight, and in 8% of the couples both the husband and wife are overweight. Is there a relationship between the weight of the husband and that of the wife? Why or why not? Use probabilities to help show this.

4. Otitis Media is a disease of the middle ear and is one of the most common diseases in those under two years of age. The national incidence rate of otitis media is 15% in the first two years of life. In a pilot study of 20 families to investigate the relationship between parental smoking and otitis media, an investigator finds that 6 children develop otitis media when both parents are smokers. We want to examine whether this evidence of increased incidence or whether it can be attributed to chance alone.
   (a) What is the incidence rate of otitis media when both parents are smokers, based on this pilot study?
   (b) Calculate the exact probability that infants, in at least 6 of these 20 families develop otitis media if the incidence rate is really 15% (as in the National incidence rates). Use the computer to help calculate.
   (c) Use the normal approximation to the Binomial to calculate this probability, first with a continuity correction and then without.
   (d) Compare the probabilities in (c) to the exact probability in (b). Comment on them.
   (e) What conclusions can you draw from this study based on these results?

   A larger study is planned, in which 200 families are recruited. This time the investigators find that 42 children develop otitis media when both parents are smokers.

   (f) What is the incidence rate based on this larger study?
   (g) Calculate the exact probability that infants, in at least 42 of these 200 families develop otitis media if the incidence rate really is 15%. Use the computer to help calculate.

(h) Use the Normal approximation to the Binomial to calculate this probability first with a continuity correction and then without.
(i) Compare the probabilities in (h) to the exact probability in (g). Comment on them.
(j) What conclusions can you draw from this pilot based on these results?

5. Among diabetics, fasting blood glucose level may be assumed to be approximately normally distributed with mean 107mg/100ml and standard deviation 8mg/100ml
(a) What percentage of diabetics have levels between 90 and 120 mg/100ml?
(b) Find the fasting blood glucose level that has the property that 25% of all diabetics have a fasting blood glucose lower than this value.
(c) Find the two average fasting blood glucose levels for a sample of 35 that have the property that 95% of the sample means have fasting blood glucose levels between these two values.

A sample of 35 consecutive patients attending your diabetes clinic have their fasting blood glucose level measured. The mean value of the 35 measurements is 109mg/100ml with a standard deviation of 8mg/100ml.

(d) Find the two fasting blood glucose levels that have the property that 95% of your sample have fasting blood glucose levels between these two values.

(e) Does it surprise you that your sample has a higher mean fasting blood glucose than is generally assumed? Explain your reasoning.