

### Homework 3 (Due on Feb 6)

January 30, 2014

STA 5172

#### Problem I

The number of legal induced abortions per year per 1000 U.S. women ages 15-44 is given in Table 4.18. For example, of 1000 women ages 15-44 in 1980, 25 had a legal induced abortion during 1980.

**Table 4.18 Annual incidence of legal induced abortions by time period**

Year	Legal induced abortions per year per 1000 women ages 15–44
1975–1979	21
1980–1984	25
1985–1989	24
1990–1994	24
1995–2004	20

1. If we assume (1) no woman has more than 1 abortion and (2) the probability of having an abortion is independent across different years, what is the probability that a 15-year old woman in 1975 will have an abortion over her 30 years of reproductive life (ages 15-44, or 1975-2004)?

Studies have been undertaken to assess the relationship between abortion and the development of breast cancer. In one study among nurses (the Nurses Health Study II), there were 16,359 abortions among 2,169,321 person-years of follow-up for women of reproductive age. (Note: 1 person-year = 1 woman followed for 1 year.)

1. What is the expected number of abortions among nurses over this time period if the incidence of abortion is 25 per 1000 women per year and no woman has more than 1 abortion?
2. Does the abortion rate among nurses differ significantly from the national experience? Why or why not? (Hint: Use the Poisson distribution.) A yes/no answer is not acceptable.

## Problem 2

The differential is a standard measurement made during a blood test. It consists of classifying white blood cells into the following five categories: (1) basophils, (2) eosinophils, (3) monocytes, (4) lymphocytes, and (5) neutrophils. The usual practice is to look at 100 randomly selected cells under a microscope and to count the number of cells within each of the five categories. Assume that a normal adult will have the following proportions of cells in each category: basophils, 0.5%; eosinophils, 1.5%; monocytes, 4%; lymphocytes, 34%; and neutrophils, 60%.

1. An excess of eosinophils is sometimes consistent with a violent allergic reaction. What is the exact probability that a normal adult will have 5 or more eosinophils?
2. An excess of lymphocytes is consistent with various forms of viral infection, such as hepatitis. What is the probability that a normal adult will have 40 or more lymphocytes?
3. What is the probability a normal adult will have 50 or more lymphocytes?
4. How many lymphocytes would have to appear in the differential before you would feel the normal pattern was violated?
5. An excess of neutrophils is consistent with several types of bacterial infection. Suppose an adult has  $x$  neutrophils. How large would  $x$  have to be for the probability of a normal adult having  $x$  or more neutrophils to be  $\leq 5\%$ ?
6. How large would  $x$  have to be for the probability of a normal adult having  $x$  or more neutrophils to be  $\leq 1\%$ ?