BS852 **HOMEWORK 3** **Due February 16, 2016**

Readings:

1. Read the document Standardization of rates and ratios by Victor J. Schoenbach
2. Read Chapter 11 of Jewell's book.

A. In the Palmer Study of the relationship between coffee consumption and risk of MI in women, we find the following information among women with angina pectoris:

Coffee (cups/day)	MI Cases	Controls	OR
0, < 1	26	18	1.0 (ref)
1, 2	57	28	1.4
3, 4	36	14	1.8
5+	41	10	2.8

Do you find significant evidence of increasing odds of MI with an increase in coffee consumption? Provide evidence for your conclusion.

B. The following data are from a case control study to examine the association between 5-years survival for breast cancer patients and estrogen receptor level (low or high). Stage of cancer at diagnosis is a possible confounder:

	Stage 1		Stage 2		Stage 3	
	Receptor low	Receptor high	Receptor low	Receptor high	Receptor low	Receptor high
Dead	2	5	9	17	12	9
Alive	10	50	13	57	2	6
Total	12	55	22	74	14	15

1. Is there evidence of a linear increase of odds for mortality with increasing stage at diagnosis?
2. Is there evidence of interaction between stage at diagnosis and receptor level?
3. Is there a significant association between receptor level and 5 years mortality?

C. Summarized in the table below are results from a follow up study. The objective is to compare disease rates between the study population (exposed individuals) and the standard population (unexposed individuals).

Confounder	Stratum 1			Stratum 2		
	Exposed	Unexposed		Exposed	Unexposed	
Disease	a_1	b_1	m_{11}	a_2	b_2	m_{12}
Not disease	c_1	d_1	m_{01}	c_2	d_2	m_{02}
Total	n_{11}	n_{01}		n_{12}	n_{02}	

1. Use the cell frequencies to complete the table below that summarizes the disease rates in the study and standard population.

	Study Population			Standard Population		
	Total Exposed	Disease Rates		Total Unexposed	Disease Rates	
Stratum 1						
Stratum 2						

2. Show that the directly standardized rate ratio can be written as:

$$DSRR = \frac{n_{01}(a_1 / n_{11}) + n_{02}(a_2 / n_{12})}{b_1 + b_2}$$

3. Show that the externally standardized rate ratio (s'RR) is equal to the DSRR.

4. How do you interpret the numerator of the DSRR?

5. How do you interpret the DSRR?

6. Show that the SMR can be written as

$$SMR = \frac{a_1 + a_2}{n_{11}(b_1 / n_{01}) + n_{12}(b_2 / n_{02})}$$

7. Show that the internally standardized rate ratio (sRR) is equal to the SMR.

8. Suppose you want to compare the results of two follow up studies conducted by two independent research centers to investigate the effect of a particular vaccination on the risk of autism in small children, controlling for the age of the mother. In the first follow up study, the sRR is 1.4. In the second follow up study, the sRR is 1.7.

    i. Can you compare the two sRR?
    ii. Assuming that the control population (unexposed) was the same in the two studies, can you compare the two sRR?
    iii. Under the same assumptions in ii), can you compare the s'RR?