

# 442s04 Assignment 6

Do these questions in preparation for Test 2 on Friday Feb. 27th. They are not to be handed in.

1. In a study of how people may get sick by staying in hospital, the cases are hospitals, and the dependent variable is "Infection risk," the (estimated) probability of getting sick in hospital. Two variables of interest are Age (average age of patient in the hospital) and Geographic Region in the U. S..

a. In the table below, set up indicator dummy variables for geographic region so that SOUTH is the reference category.

Region	D1	D2	D3
NORTHEAST			
NORTH CENTRAL			
SOUTH			
WEST			

b. Representing infection risk by  $Y$ , age by the variable  $x$ , and your three dummy variables by  $D1$ ,  $D2$  and  $D3$ , write a regression equation with an intercept and 4 independent variables. Complete the equation below.

$$E[Y] =$$

c. Give  $E[Y]$  for each region. The symbols " $D1$ ,"  $D2$ " and " $D3$ " should *not* appear in your answer.

Region	$E[Y]$
NORTHEAST	
NORTH CENTRAL	
SOUTH	
WEST	

- d. For the Northeast region, when average patient age is increased by one year, expected infection risk increases by \_\_\_\_\_.
- e. For the West region, when average patient age is increased by one year, expected infection risk increases by \_\_\_\_\_.
- f. For *any* region, when average patient age is increased by one year, expected infection risk increases by \_\_\_\_\_.
- g. Controlling for average patient age, the difference between expected infection risk in the Northeast and South regions is \_\_\_\_\_.
- h. Controlling for average patient age, the difference between expected infection risk in the North Central and South regions is \_\_\_\_\_.
- i. Controlling for average patient age, the difference between expected infection risk in the Northeast and West regions is \_\_\_\_\_.
- j. What does  $\beta_0$  mean?
- k. Suppose we simultaneously tested D1, D2 and D3 (or equivalently,  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$ ), and the test was not significant. What would you conclude?
  - l. Is this study experimental, observational, or both? Why?
  - m. Suppose the results in (k) were statistically significant. Could you conclude that the difference in infection risk was caused by differences in how hospitals are run in the different regions? Why or why not?

2. In a government study of Canadian business, companies were classified as either heavy manufacturing (type=1), light manufacturing (type=2), retail (type=3) or service (type=4). The size of each company was also recorded, as well as the profit after taxes.

- a. Make a table showing how you would set up indicator dummy variables for type of business.
- b. You want to know whether average profit after taxes is related to type of business, once you control for size of company.
  - i) Give  $E[Y]$  for the full model.
  - ii) Give  $E[Y]$  for the reduced model.

3. In a study of the fuel efficiency of automobiles, investigators selected independent random samples of automobiles located in Canada and manufactured in either (1) North America, (2) Japan, (3) Europe, or (4) Other location. The dependent variable  $Y$  is kilometers per litre.

a. Write this as a multiple regression model with  $r-1$  dummy variables; call them  $x_1$ ,  $x_2$  and  $x_3$ . You do not need to define how the dummy variables are coded; you are asked to do that in the next part of this question. In fact, all you need to do is complete this:

$$E[Y] =$$

b. In the table below, define dummy variables for location of car's manufacture. Make North American the reference category.

Country of Origin	$x_1$	$x_2$	$x_3$
1 = N. America			
2 = Japan			
3 = Europe			
4 = Other			

c. The difference in average fuel efficiency between Japanese and European cars is \_\_\_\_.

d. You want to know whether average fuel efficiency is related to location.

- i) Give  $E[Y]$  for the full model.
- ii) Give  $E[Y]$  for the reduced model.