Name ________________________

Student Number ________________

Test 3 STA302F94

Aids Allowed: Calculator; formula sheet supplied

1. 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. The SAS command file begins as follows:

```
data business;
     infile 'company.dat';
     input type size profit;
```

a. (5 pts) Give SAS statements to create indicator dummy variables for company type, with heavy manufacturing as the reference category. Do NOT include any interaction terms or polynomial terms yet.

b. (5 pts) Once we control for company size, is type of company related to amount of profit? Give two `proc reg` statements, one for the full model and one for the reduced model.

We are still on the company type & profit example of page one.

c. (5 pts) Give SAS statements to create terms for the interaction between company type and company size. (Naturally, these would go in the data step).

d. (5 pts) You want to test whether the differences in profit among different types of company depend on the size of the company. Give two `proc reg` statements, one for the full model and one for the reduced model.

e. (5 pts) You want to test whether the slopes of the four regression lines relating company size to profit are all parallel. Give two `proc reg` statements, one for the full model and one for the reduced model.

We are still on the company type & profit example of page one.

f. (5 pts) The hypothesis of part (e) above could be tested with the general linear test H_0: $\mathbf{C}\boldsymbol{\beta} = \mathbf{h}$ approach. Give the $\mathbf{C}$, $\boldsymbol{\beta}$ and $\mathbf{h}$ matrices.

g. (5 pts) You want to test whether the four regression lines relating company size to profit are all equal. This means they have the same slope <u>and</u> the same intercept. Give the $\mathbf{C}$ and $\mathbf{h}$ matrices ($\boldsymbol{\beta}$ is the same as in part f).

2. For the following command file, you want to test H_0: β_1=4 and β_2=β_3 simultaneously (it's one null hypothesis).

```
data quest2;
     infile 'q2.dat';
     input X1 X2 X3 Y;




proc reg; /* full model */
     model Y = X1 X2 X3;
```

a. (10 pts) Add some statements to the data step (write them in above) and then write the proc reg statement for the reduced model right under the one for the full model.

b. (5 pts) Give the **C,** $\boldsymbol{\beta}$ and **h** matrices for the H_0: $\mathbf{C}\boldsymbol{\beta} = \mathbf{h}$ approach.

3. (12 pts) The formula sheet has a SAS command file for the cars data. Note that the dummy variable coding is very different from what you were asked to do in homework. Fill in the table below. Remember weight and length are in the model. You can use x_3 for weight and x_4 for length.

	Value of c1	Value of c2	Expected MPG
U. S.			
Japan			
Other			

The remaining questions refer to the SAS output on the back of the formula sheet.

4. We want to know, if we take the car's country of origin into account, whether weight and length (considered simultaneously) are significantly related to gas mileage?

a. (6 pts) What is the F* statistic that can be used to answer this question?

b. (2 pts) If there is a p–value on the printout for this test then give it. Otherwise just write "No p–value on printout."

5. (30 pts) Please fill in the table below. You must get the whole row correct in order to get credit for the question.

Question	Value of F* or t*	p–value	Yes or no at α=.05
If we control for country and weight, is length related to MPG?			
If we control for country and length, is weight related to MPG?			
If we control for weight and length, do US and Japanese cars get different mileage from U.S. cars?			
Controlling for weight and length, is expected MPG for a US car different from expected MPG for an Other car?			
Controlling for weight and length, is the expected mileage for a US car different from the average of the expected mileages of Japanese cars and Other cars?			

Total = 100 Points