STAT436 **Homework 4** **Due Tuesday January 28th at 2.30pm**

Directions: Below are three questions from last year's first exam. Students are to answer all three exercises, showing all relevant work. As always, conclusions and justifications are to be given in clear detailed English. For each exercise and part, be sure to clearly write down all needed assumptions and requirements. Please type up your solutions or write ***very*** neatly. Unless stated otherwise, use $\alpha = 0.05$.

1. Amphetamine is a drug that it is felt suppresses appetite. To test this effect, a pharmacologist randomly allocated 24 rats to receive one of three treatment groups (to receive an injection of amphetamine at one of two dosage levels or an injection of saline solution, i.e., amphetamine at zero dose level). She then measured the amount of food consumed by each animal in the 3-hour period following injection, and these data are reproduced, graphed and analyzed on p.1 of the *Appendix*. Her goal is to test whether there is a significant linear relationship between amphetamine dose and food consumption.

   (a) State the assumptions that must be made for this SLR analysis **in the context of this study**. Be specific and clear.

   (b) Test whether there is a significant linear relationship between amphetamine dose and food consumption. Be sure to write out the statistical model function, the null and alternative hypotheses, value of the relevant test statistic (TS) and distribution (including df), p-value, and your detailed and clear conclusion. ***The hypotheses to be tested here are implied in the description above!***

   Statistical Model Function _____

   Null _____Alternative _____

   TS _____ df _____ p-value _____

   Detailed and clear conclusion

   (c) Clearly interpret the estimate of the slope parameter in this SLR model **in the context of this study**. Give the units in your answer.

2. The new cholesterol-lowering supplement, Fibralo, was studied in a double-blind study against the marketed reference supplement, Gemfibrozil, in 34 non-insulin dependent diabetic patients. The study's objective was to compare the mean decrease in triglyceride levels (denoted "triglyceride_change" in the dataset) between the two treatment groups. The degree glycemic control, measured by hemoglobin A_{1c} levels (denoted "hemoglobin" in the dataset), was thought to be an important factor as well. This covariate was measured at the start of the study and is shown in the data listing in the *Appendix* with the percent changes in triglycerides from pre-treatment to the end of the 10-week trial. The data are graphed, listed and analyzed using Minitab in the *Appendix*.

   (a) After removing the hemoglobin covariate, test whether there is a difference in mean responses between supplements. **For this part only, assume that the respective lines are parallel**. Give the relevant Minitab output # to use in the analysis, null and alternative hypothesis, observed test statistic and distribution (including df), p-value and detailed conclusion.

   Use Minitab output # _____ Write out model function: E(Y) = _____

   Null _____Alternative _____

TS _____ df _____ p-value _____

Detailed conclusion

(b) No longer making the parallelism assumption used in part (a), test whether a single regression line could be used for the two groups for the data graphed in the *Appendix*, clearly writing out your statistical model, your new hypotheses, calculated test statistic and its distribution (with df), p-value, and your detailed and clear conclusion. Identify the relevant output number(s).

Write out the model function: E(Y) = _____

Null hypothesis _____

Alternative hypothesis _____

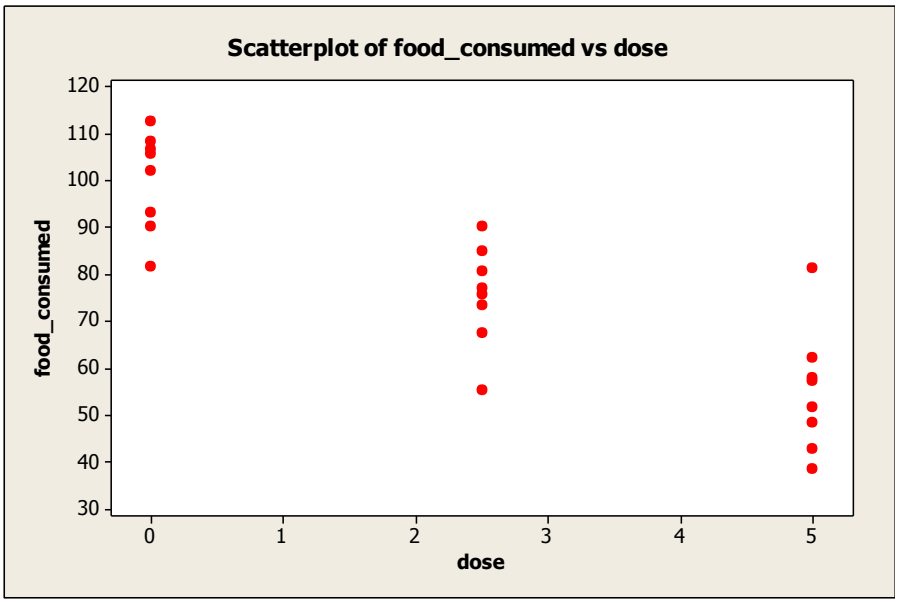
Showing your calculations, give the calculated test statistic _____

Degrees of freedom _____ p-value _____

Detailed and clear conclusion

3. Returning to Exercise 2, if the covariate (hemoglobin) was ignored and we wanted to compare the treatment means, what would our conclusion be and why? The correct output here is output # _____

Exercise 1 graph, data-listing, and output



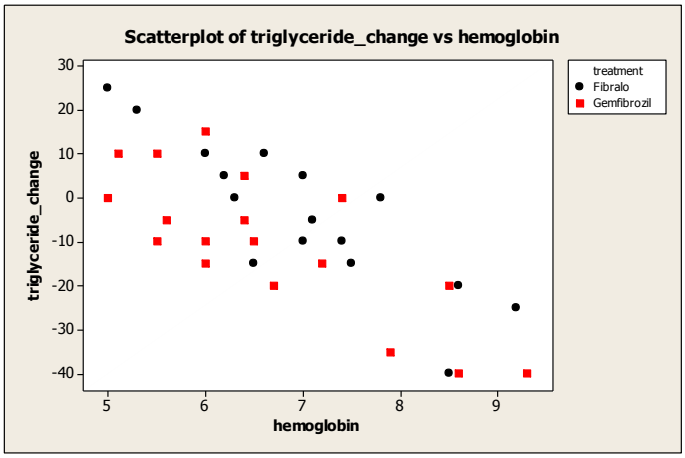
	Dose = 0.0 mg/kg	Dose = 2.5 mg/kg	Dose = 5.0 mg/kg
	112.6	73.3	38.5
	102.1	84.8	81.3
	90.2	67.3	57.1
	81.5	55.3	62.3
	105.6	80.7	51.5
	93.0	90.0	48.3

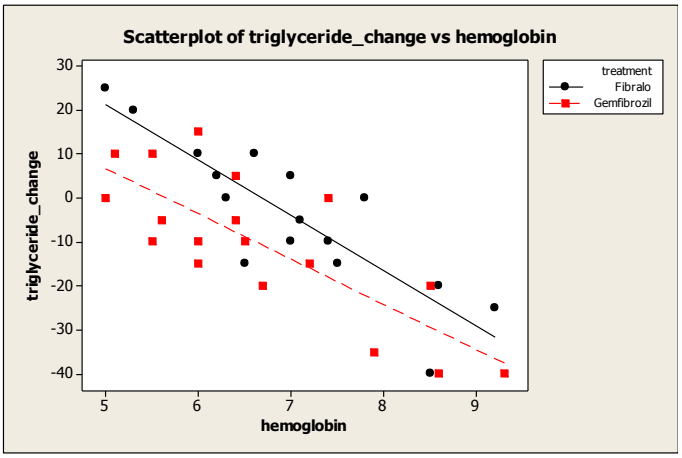
	106.6	75.5	42.7
	108.3	77.1	57.9
Mean (g/kg)	100.0	75.5	55.0
SD (g/kg)	10.7	10.7	13.3
No. of animals	8	8	8

Output 1.1. Regression Analysis: food_consumed versus dose

```
The regression equation is
food_consumed = 99.3 - 9.01 dose

Predictor         Coef     SE Coef           T        P
Constant        99.331       3.680       26.99    0.000
dose            -9.008       1.140       -7.90    0.000

S = 11.40       R-Sq = 73.9%     R-Sq(adj) = 72.8%

Analysis of Variance
Source             DF          SS          MS          F        P
Regression          1      8113.5      8113.5      62.41    0.000
Residual Error     22      2859.9       130.0
Total              23     10973.4
```

Exercises 2 & 3 graphs, data-listing, and output





Patient number	Treatment	Hemoglobin	Triglyceride_change	Dummy	Product
1	Fibralo	7.0	5	1	7.0
2	Fibralo	6.0	10	1	6.0
3	Fibralo	7.1	-5	1	7.1
4	Fibralo	8.6	-20	1	8.6
5	Fibralo	6.3	0	1	6.3
6	Fibralo	7.5	-15	1	7.5
7	Fibralo	6.6	10	1	6.6
8	Fibralo	7.4	-10	1	7.4
9	Fibralo	5.3	20	1	5.3
10	Fibralo	6.5	-15	1	6.5
11	Fibralo	6.2	5	1	6.2

12	Fibralo	7.8	0	1	7.8
13	Fibralo	8.5	-40	1	8.5
14	Fibralo	9.2	-25	1	9.2
15	Fibralo	5.0	25	1	5.0
16	Fibralo	7.0	-10	1	7.0
17	Gemfibrozil	5.1	10	0	0
18	Gemfibrozil	6.0	15	0	0
19	Gemfibrozil	7.2	-15	0	0
20	Gemfibrozil	6.4	5	0	0
21	Gemfibrozil	5.5	10	0	0
22	Gemfibrozil	6.0	-15	0	0
23	Gemfibrozil	5.6	-5	0	0
24	Gemfibrozil	5.5	-10	0	0
25	Gemfibrozil	6.7	-20	0	0
26	Gemfibrozil	8.6	-40	0	0
27	Gemfibrozil	6.4	-5	0	0
28	Gemfibrozil	6.0	-10	0	0
29	Gemfibrozil	9.3	-40	0	0
30	Gemfibrozil	8.5	-20	0	0
31	Gemfibrozil	7.9	-35	0	0
32	Gemfibrozil	7.4	0	0	0
33	Gemfibrozil	5.0	0	0	0
34	Gemfibrozil	6.5	-10	0	0

Output 2.1. Regression Analysis: triglyceride_change versus hemoglobin

```
The regression equation is
triglyceride_change = 65.0 - 10.6 hemoglobin

Predictor         Coef     SE Coef           T        P
Constant         65.05       10.81        6.02    0.000
hemoglobin     -10.629       1.564       -6.80    0.000

S = 10.85       R-Sq = 59.1%     R-Sq(adj) = 57.8%

Analysis of Variance
Source             DF          SS          MS         F        P
Regression          1      5442.7      5442.7     46.21    0.000
Residual Error     32      3769.1       117.8
Total              33      9211.8
```

Output 2.2. Regression Analysis: triglyceride_change versus dummy, hemoglobin, product

```
The regression equation is
triglyceride_change = 58.0 + 26.0 dummy - 10.3 hemoglobin - 2.30 product

Predictor        Coef     SE Coef          T        P
Constant        58.05       12.66       4.58    0.000
dummy           26.00       19.92       1.31    0.202
hemoglobin    -10.283       1.875      -5.49    0.000
product        -2.304       2.867      -0.80    0.428

S = 9.734       R-Sq = 69.1%     R-Sq(adj) = 66.1%

Analysis of Variance
Source            DF          SS          MS         F        P
Regression         3      6369.3      2123.1     22.41    0.000
Residual Error    30      2842.5        94.7
Total             33      9211.8
```

Output 2.3. Regression Analysis: triglyceride_change versus dummy

```
The regression equation is
triglyceride_change = - 10.3 + 6.22 dummy

Predictor        Coef     SE Coef          T        P
Constant      -10.278       3.927      -2.62    0.013
Dummy           6.215       5.725       1.09    0.286

S = 16.66       R-Sq = 3.6%      R-Sq(adj) = 0.5%

Analysis of Variance
Source            DF          SS          MS         F        P
Regression         1       327.2       327.2      1.18    0.286
Residual Error    32      8884.5       277.6
Total             33      9211.8
```

Output 2.4. Regression Analysis: triglyceride_change versus dummy, hemoglobin

```
The regression equation is
triglyceride_change = 64.6 + 10.2 dummy - 11.3 hemoglobin

Predictor        Coef     SE Coef          T        P
Constant       64.593       9.643       6.70    0.000
Dummy          10.222       3.363       3.04    0.005
hemoglobin    -11.268       1.410      -7.99    0.000

S = 9.678       R-Sq = 68.5%     R-Sq(adj) = 66.4%

Analysis of Variance
Source            DF          SS          MS         F        P
Regression         2      6308.1      3154.0     33.67    0.000
Residual Error    31      2903.7        93.7
Total             33      9211.8
```