FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

MID-TERM ASSESSMENT EXAMINATION 2

MODULE TITLE: Applied Statistic for Administration DURATION OF EXAM: 45 minutes

LECTURER: Mr. Kevin O'Brien GRADING SCHEME: 15 marks

INSTRUCTIONS TO CANDIDATES

- This exam will start at 12:05, and will last 45 minutes.
- Each question will be worth either 1 or 2 Marks. There are 15 Marks worth of questions.
- All questions must be attempted (LENS students please see below)
- Write all of your answers in the exam script. Write the script number on any other documents you submit.
- It is your responsibility to return the script to collection box. An audit of scripts will take place immediately after the exam. If your script is account for in that audit, you are deemed to be absent, and will receive no marks.
- **IMPORTANT for LENS Student:** Specifically approved LENS students have to answer any selection of questions that have an aggregate mark of 12 Marks.
  - They may skip any three of the 1-Mark Questions
  - OR - They may skip a 1-Mark Question and a 2-Mark Question
  - The mark will be rescaled by 125 %.
  - They are advised to skip questions that are indicated by an asterisk symbol ("$*$"), but it is not compulsory that they do so.

Question 1 - One Way ANOVA (9 Marks)

Specimens of milk from dairies in three different districts are assayed for their concentrations of the radioactive isotope Strontium-90. The results, in picocuries per litre, are as shown in the table below.

District							mean $\bar{x}_i$	variance s_i^2
A	7.6	8.1	8.5	8.3	7.9	8.8	8.2	0.184
B	8.7	10.2	11.4	10.9	7.2	9.2	9.6	2.404
C	10.3	9.9	11.5	11.6	10.6	8.5	10.4	1.312
Overall							9.4	2.022

(i) (2 Marks) Showing your workings, compute the **Between Group Sum of Squares** (*SSbetween*).

(ii) (2 Marks) Showing your workings, compute the **Within Group Sum of Squares** (*SSwithin*).

(iii) (2 Mark) Showing your workings, compute the **Total Group Sum of Squares** (*SStotal*).

(iv) (1 Mark)[$*$] Complete the **Degrees of Freedom** Column for the ANOVA table below.

(iv) (1 Mark)[$*$] Complete the **Mean Square** Column for the ANOVA table below.

(iv) (1 Mark)[$*$] Complete the **F** Column (i.e. the column for Test Statistic) for the ANOVA table below.

	DF	SS	MS	F
Between				
Within				
Total				

(Blank)

Question 2 - Two Way ANOVA (6 Marks)

Suppose you want to determine whether the brand of cleaning product used and the temperature affects the amount of dirt removed from your machinery.
You are also interested in determining if there is an interaction between the two variables.

You buy two different brand of detergent ("*Super*" and "*Best*") and choose three different temperature levels ("*Cold*, "*Warm*", and "*Hot*"). There are four measurements per treatment group.

	Cold	Warm	Hot
Super	4,5,6,5	7,9,8,12	10,12,11,9
Best	6,6,4,4	13,15,12,12	12,13,10,13

- Detergent is Factor A.
- Temperature is Factor B.
- The variance of the response variable is 12.2011.

Source	DF	SS	MS	F
A	?	22.04	?	?
B	?	?	102.37	?
A:B	?	16.08	?	?
Resid	?	?	?	
Total	?	?		

Exercises

For the Table above, replace the questions marks with the correct values in each of the following columns. (The number of marks for each column is indicated here:)

(i) (2 Marks) Degrees of freedom

(ii) (2 Mark) Sums of Squares column

(iii) (1 Mark)[$*$] Mean Square Values

(iv) (1 Mark)[$*$] F-Values

(You may use the blank table on the next page)

Source	DF	SS	MS	F
A				
B				
A:B				
Resid				
Total				

(Blank)