BIII (Linear Model) 2018-19   **Assignment I**   **(Due date September 19, 2018)**

(NO LATE ASSIGMENT WILL BE ACCEPTED)

(SHOW R CODE FOR EACH STEP OF THE FOLLOWING PROBLEMS)

1. A firm wishes to compare four programs for training workers to perform a certain manual task. Twenty new employees are randomly assigned to the training programs, with 5 in each program. At the end of the training period, a test is conducted to see how quickly trainees can perform the task. The number of times the task is performed per minute is recorded for each trainee, with the following results:

     Program 1:   9, 12, 14, 11, 13
     Program 2:   10, 6, 9, 9, 10
     Program 3:   12, 14, 11, 13, 11
     Program 4:   9, 8, 11, 7, 8

     Each one of you select two random numbers from 1 to 4, and again one random number from 1 to 5. Corresponding to the two random numbers selected from 1 to 4, you consider the two programs and delete the observation corresponding to the number selected from 1 to 5, for each of the two selected programs. Thus in the above data, all of you have to work with 5 observations for two programs and 4 observations for the other two programs.

  (a) Construct the ANOVA table (b) Using $\alpha = .05$, determine whether the treatments differ in their effectiveness., (c) Construct 3 independent meaningful contrasts of the effects of programs such that the S.S due to these contrasts add up to the between group contrasts.

2. Twenty-four missiles were selected from a large production batch. The missiles were randomly split into three groups of size eight. The first group of eight had engine type 1 installed, the second group had engine type 2, and the third group received engine type 3. Each group of eight was randomly divided into four groups of two. The first such group was assigned propellant type 1, the second group was assigned propellant type 2, and so on. Data on burn rate were collected, as follows:

Engine type	Propellant type			
	Type 1	Type 2	Type 3	Type 4
1	34.0, 32.7	30.1, 32.8	29.8, 26.7	29.0, 28.9
2	32.0, 33.2	30.2, 29.8	28.7.28.1	27.6, 27.8
3	28.4, 29.3	27.3, 28.9	29.7,27.3	28.8, 29.1

Each one of you select a random sample of size 12 with replacement from {1,2} and select the observation corresponding to your sample from each of this cell. Thus you have a data on two way table with single observation per cell. Now complete the ANOVA table assuming a fixed effects two way model without interaction and carry out the appropriate test to determine whether either factor, engine type (factor A) or propellant type (factor B), has a significant effect on burn rate.