STATISTICS 642 - ASSIGNMENT 1

DUE DATE: 8am Central, Thursday, February 3, 2022

Name (**Typed**) _____

Email Address (**Typed**) _____

Make this cover sheet the first page of your Solutions.

STATISTICS 642 - ASSIGNMENT #1

- Due 8am Central Thursday, February 3, 2022
- Read: Handout 1
- Supplemental Reading: Chapters 1 and 2 in the Design & ANOVA book
- **Hand in the following problems:**

1. (20 points) A study is planned on the physiology of exercises with human subjects. The two treatments in the study are two methods of aerobic exercise training (Methods A and B). At the end of a ten-week exercise period, each subject will undergo a treadmill test for standard respiratory and cardiovascular measurements. Nineteen subjects are listed in the following table by sex and age. All subjects are in good health and in the normal weight range for their age, sex, and height. The 19 subjects will be divided so that eight subjects will be evaluated in each of the exercise methods, that is, only 16 of the 19 subjects will participate. Each of the 16 subjects will be assigned to one and only one of the two exercise methods.

Individual	1	2	3	4	5	6	7	8	9	10
Sex	M	M	F	F	F	F	M	F	M	M
Age	54	38	41	18	19	39	51	44	62	18
Individual	11	12	13	14	15	16	17	18	19	
Sex	M	F	M	M	F	F	M	M	F	
Age	31	18	58	74	68	21	35	34	38	

   a. How you would group the subjects prior to the assignment of the two treatments so that the experimental error variances would be as small as possible. Explain why you grouped the subjects in the manner that you provided.

   b. Display your assignment of the 16 subjects to the two treatments.

2. (20 points) The EPA wants to investigate deposits on a filter in a cooling system. The factors of interest are

   - Factor 1: Flow Rate: 5 and 10 gps
   - Factor 2: Filter Diameter: 0.5, 1 and 2 cm
   - Factor 3: Fluid Temperature: 75, 100, and 125° F

   A run consists of switching out a filter to the correct diamenter, changing the flow rate, heating the fluid to the selected temperature, and then pressing the start button. After a specified period of time, the amount of deposit on the filter is measured. A maximum of 20 tests runs can be made with each batch of cooling fluid because of impurities that enter the cooling system. It is possible to have several batches of cooling fluid used in the experiment but the study's budget will only allow a maximum of 75 total test runs in the complete experiment. Provide a complete description of how you would design an experiment to meet the above specifications.

3. (20 points) An experiment is planned to compare three methods of instruction:

   - Method 1: Instructor lectures three times/week
   - Method 2: All materials provided over the web with a weekly Question and Answer session with the instructor
   - Method 3: Students read materials before class and there is instructor-student discussion during the three times/week class time

   Each of the three methods is evaluated with a single classroom of 25 students. The three instructors selected for the study are randomly assigned to a single classroom. The researcher will use the results of four exams given to the 75 students over the 15 week semester to compare the three methods of instruction.

   a. Provided a short (100 words or less) critique of the proposed experiment.

   b. Describe how the experiment could be improved?

4. (20 points) An experiment involving four treatments (T1, T2, T3, T4) and 24 experimental units (EU's) was conducted.

   a. How many different randomizations are possible if six EU's are randomly assigned to each of the four treatments.

   b. How many different randomizations are possible if the 24 EU's are randomly assigned to the treatments with 6 EU's to T1, 5 EU's to T2, 7 EU's to T3, and 6 EU's to T4.

5. (20 points) For the following experiment, identify the following components of the experimental design (some may be absent in the experiment):

1. Factor(s)	4. Factor Levels	7. Treatments	10. Response
2. Experimental Units	5. Measurement Units	8. Replications	11. Subsampling
3. Covariates	6. Blocking	9. Confounding	

   An experiment was run to assess the compressive strength of the cover on golf balls. The experimental plan includes random sampling of balls from four brands (B_1, B_2, B_3, B_4) of golf balls. Furthermore, each brand of golf ball has three thickness of covers (T_1, T_2, T_3) and two types of cover materials (M_1, M_2). The compressive strength of the golf ball was recorded at five randomly selected spots on each golf ball in the study. A total of six golf balls were evaluated for each combination of Brand, Thickness and Material Type. There are two major testing facilities so half of the balls are tested at one facility and the remaining balls at the second facility. The testing is done inside at a controlled temperature.