Homework 2

STAT 514

Introduction: Some of the problems will require SAS. Please include your SAS code as well as the relevant outcome. Failure to include will result in loss of partial credit.Your work must be clearly written.

1. Give an example design for each of the following: 1) Completely randomized design; 2) Block design; 3) Split-plot design. For each design, specify the treatment factors and their levels. You may come up with designs of your own or use examples in literature (books, papers or Internet). If you use an example in literature, please provide references.

2. The Trout Experiment is described in the book on page 67 . The following problems are meant for you to familiarize notations.

a. Calculate the sample mean $\bar{y}_{i\cdot}$ for each treatment.
b. Which estimates $\hat{\mu}_i$ minimize the sum of squares $\sum_{i=1}^{4}\sum_{t=1}^{10}\left(Y_{it}-\hat{\mu}_i\right)^2$? Find this minimum.
c. If someone uses the following estimates for the treatment means, $\hat{\mu}_1 = 6, \hat{\mu}_2 = 9, \hat{\mu}_3 = 8, \hat{\mu}_4 = 9$, calculate $\sum_{i=1}^{4}\sum_{t=1}^{10}\left(Y_{it}-\hat{\mu}_i\right)^2$ and verify that it is bigger than the minimum obtained by the estimates in b.
d. Calculate a 95% confidence upper limit for σ^2.
e. Test the hypothesis that sulfamerazine has no effect on the hemoglobin content of trout blood or equivalently, all treatment means are equal. Use $\alpha = 0.05$ to make a conclusion whether to reject or fail to reject the null hypothesis.

3. The heart-lung pump experiment is described in Example 3.4.1, page 37 and the data are shown in Table 3.2, page 38.

a. Use SAS to calculate the ANOVA table and test the null hypothesis that the number of revolutions per minute has no effect on the fluid flow rate. Use $\alpha = 0.05$.
b. Calculate a 90% upper confidence limit for the error variance.

4. In an experiment to compare three diets on weight control, the experimenter would like to be able to detect a difference of 4 kilograms in weight with a probability 90% if he was to use a level of significance $\alpha = 0.05$. The experimenter estimates that the variance of weight will be no more than 36 squared kilograms. Calculate the necessary sample size for each treatment assuming the equal sample size is used for all treatments