**H/Design/Sem6/Problem Set 1 Date:**

**Layout and Analysis of Standard Designs**

1. Construct the layout of a Completely Randomized Design with 5 treatments being replicated 4,5,3,2 and 4 times.
2. Construct the layout of a Randomized Block Design with 5 treatments and 4 blocks.
3. i) Construct a 4x4 Latin Square Design (LSD) with the treatments A,B,C,D.

ii) Construct a 5x5 Latin Square Design (LSD) with the treatments A,B,C,D,E.

iii) Construct a 6x6 Latin Square Design (LSD) with the treatments A,B,C,D,E,F.

1. A person wanting to purchase electric drills got quotations from five manufacturers. For selections, he wanted to conduct an experiment to estimate the time taken by each in making a hole in a metallic sheet. He marked 20 places on the sheet and applied five drills, labeled D1, D2, D3, D4, D5 from each concern in randomly selected places to make the holes. The time for making each hole was recorded in seconds. The layout of the metallic sheet was as follows :

|  |  |  |  |
| --- | --- | --- | --- |
| D1 (19) | D3 (22) | D4 (20) | D1 (20) |
| D5 (29) | D2 (24) | D5 (30) | D3 (24) |
| D2 (26) | D4 (25) | D1 (16) | D2 (22) |
| D5 (28) | D4 (25) | D5 (31) | D4 (28) |
| D4 (27) | D2 (16) | D2 (27) | D3 (20) |

Analyze the model. Which drills create the difference in the time?

1. To estimate the petrol consumption rates of different makes of cars for suitable average speed, five different cars each of four different makes were put on road on 5 different days. The cars of a make ran with different speeds, 25, 35, 50, 60 and 70 mph on 5 different days. For each car, the number of miles per gallon of petrol was observed. The layout is given below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Makes of Car | Speeds of Cars in Miles per hour (mph) | | | | |
| 25 | 35 | 50 | 60 | 70 |
| A | 20.6 | 19.5 | 18.1 | 17.9 | 16.0 |
| B | 19.5 | 19.0 | 15.6 | 16.7 | 14.1 |
| C | 20.5 | 18.5 | 16.3 | 15.2 | 13.7 |
| D | 16.2 | 16.5 | 15.7 | 14.8 | 12.7 |

i) Identify the layout and the factors. Setup a suitable model for the data.

ii) Does the coverage differ significantly on the Makes of the Cars?

Test the same at 5% level of significance.

iii) If your answer to (ii) is in the negative, which makes account for the difference?

1. Read the “*OrchardSprays*” dataset in R. Identify the design and carry out the test for differential effects of the various constituents of orchard sprays in repelling honeybees. Interpret the result. If the hypothesis is rejected, find out which pairs of sprays cause the differential effects.
2. i) Consider the following ANOVA table of an RBD.

|  |  |  |
| --- | --- | --- |
| **Sources of Variation** | **d.f.** | **SS** |
| Blocks | 3 | 3.2947 |
| Treatments | 4 | 68.8917 |
| Error | 12 | 3.2767 |

Estimate the efficiency of the RBD with respect to a CRD and comment.

ii) Consider the following ANOVA table of a LSD.

|  |  |  |
| --- | --- | --- |
| **Sources of Variation** | **d.f.** | **SS** |
| Rows | 7 | 102.19 |
| Columns | 7 | 84.24 |
| Treatments | 7 | 513.79 |
| Error | 42 | 92.00 |

Estimate the efficiency of the LSD (once with rows as blocks and once with

columns as blocks) with respect to an RBD and comment.