THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. Degree Programme

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ADU5319 – DESIGN AND ANALYSIS OF EXPERIMENTS

OPEN ELECTIVES - LEVEL 05

NO BOOK TEST 2023/2024

Duration: One Hour

Date: 27.01.2024 **Time: 02.30 p.m- 03.30 p.m**

- **This question paper consists of 02 questions and 03 pages.**
- **Answer all questions**
- **F statistical table is attached in the last page.**
- **Non-programmable calculators are permitted.**
- **Consider the level of significance as 0.05 for all the tests.**

Question 01

Suppose that a drug company wishes to test the effects of five new compounds namely A,B,C,D,E, on the growth rate of white rats. Twenty rats from different litters L_1,L_2,L_3,L_4 were available for the experiment (Rats of the same litter can be considered homogeneous in their characteristics than rats of different litters). There were 5 rabbits in each litter and 5 compounds were given for 5 rats in each litter. Body weight gains (g) are given in the following table after 3 months of feeding the compound.

Litter	Compound				
	A	***B***	***C***	***D***	***E***
L_1	1.45	1.08	1.72	1.04	0.98
L_2	1.39	1.21	1.45	0.79	1.07
L_3	0.86	0.99	1.42	0.01	1.32
L_4	1.04	0.76	0.97	1.05	0.85

Total sum of squares = 2.435

(i) Write down the hypotheses to be used.

(ii) Test whether all the compounds have the same effect on body weight gains. Interpret your results.

(iii) Find out if there are any differences that exist among litters. Justify your answer.

Question 02

A researcher wants to study the effect of four diets (*A, B, C, D*) on weight gain (in kilograms) of cattle in a certain farm. It was believed that weight gain is affected by age of the animal and genetic factors. Animals were grouped by age and genetic factors. They were weighted at the beginning of the study period. The different diets were given to the animals for a period of three months, and then they were re-weighted. The study plan and the weight gain over the three months' period are given below:

Genetic Group	**Age Group**				**Total**
	1	**2**	**3**	**4**	
1	5 (*A*)	7 (*B*)	4 (*C*)	3 (*D*)	**19**
2	10 (*B*)	8 (*A*)	5 (*D*)	5 (*C*)	**28**
3	7 (*C*)	5 (*D*)	6 (*A*)	12 (*B*)	**30**
4	10 (*D*)	11 (*C*)	15 (*B*)	12 (*A*)	**48**
Total	**32**	**31**	**30**	**32**	**125**

Total sum of squares = 180.44

Diet	***A***	***B***	***C***	***D***
total	31	44	27	23

(i) Identify the design used in this experiment. Justify your answer.

(ii) Construct the ANOVA table and test appropriate hypotheses. Interpret your results.

(iv) The estimated error variance in an RCBD with the age as blocks was 13.06. Which design do you prefer? Justify your answer.

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Appendix 4a

5 per cent Points of the *F*-distribution

Column represents degrees of freedom (ν_1) for numerator of *F*-test
Row represents degrees of freedom (ν_2) for denominator of *F*-test

	1	2	3	4	5	6	7	8	9	10	12	24	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	249.1	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.45	19.50
3	10.13	9.552	9.277	9.117	9.013	8.941	8.887	8.845	8.812	8.785	8.745	8.638	8.526
4	7.709	6.944	6.591	6.388	6.256	6.163	6.094	6.041	5.999	5.964	5.912	5.774	5.628
5	6.608	5.786	5.409	5.192	5.050	4.950	4.876	4.818	4.772	4.735	4.678	4.527	4.365
6	5.987	5.143	4.757	4.534	4.387	4.284	4.207	4.147	4.099	4.060	4.000	3.841	3.669
7	5.591	4.737	4.347	4.120	3.972	3.866	3.787	3.726	3.677	3.637	3.575	3.410	3.230
8	5.318	4.459	4.066	3.838	3.688	3.581	3.500	3.438	3.388	3.347	3.284	3.115	2.928
9	5.117	4.256	3.863	3.633	3.482	3.374	3.293	3.230	3.179	3.137	3.073	2.900	2.707
10	4.965	4.103	3.708	3.478	3.326	3.217	3.135	3.072	3.020	2.978	2.913	2.737	2.538
11	4.844	3.982	3.587	3.357	3.204	3.095	3.012	2.948	2.896	2.854	2.788	2.609	2.405
12	4.747	3.885	3.490	3.259	3.106	2.996	2.913	2.849	2.796	2.753	2.687	2.505	2.296
13	4.667	3.806	3.411	3.179	3.025	2.915	2.832	2.767	2.714	2.671	2.604	2.420	2.206
14	4.600	3.739	3.344	3.112	2.958	2.848	2.764	2.699	2.646	2.602	2.534	2.349	2.131
15	4.543	3.682	3.287	3.056	2.901	2.790	2.707	2.641	2.588	2.544	2.475	2.288	2.066
16	4.494	3.634	3.239	3.007	2.852	2.741	2.657	2.591	2.538	2.494	2.425	2.235	2.010
17	4.451	3.592	3.197	2.965	2.810	2.699	2.614	2.548	2.494	2.450	2.381	2.190	1.960
18	4.414	3.555	3.160	2.928	2.773	2.661	2.577	2.510	2.456	2.412	2.342	2.150	1.917
19	4.381	3.522	3.127	2.895	2.740	2.628	2.544	2.477	2.423	2.378	2.308	2.114	1.878
20	4.351	3.493	3.098	2.866	2.711	2.599	2.514	2.447	2.393	2.348	2.278	2.082	1.843
21	4.325	3.467	3.072	2.840	2.685	2.573	2.488	2.420	2.366	2.321	2.250	2.054	1.812
22	4.301	3.443	3.049	2.817	2.661	2.549	2.464	2.397	2.342	2.297	2.226	2.028	1.783
23	4.279	3.422	3.028	2.796	2.640	2.528	2.442	2.375	2.320	2.275	2.204	2.005	1.757
24	4.260	3.403	3.009	2.776	2.621	2.508	2.423	2.355	2.300	2.255	2.183	1.984	1.733
25	4.242	3.385	2.991	2.759	2.603	2.490	2.405	2.337	2.282	2.236	2.165	1.964	1.711
26	4.225	3.369	2.975	2.743	2.587	2.474	2.388	2.321	2.265	2.220	2.148	1.946	1.691
27	4.210	3.354	2.960	2.728	2.572	2.459	2.373	2.305	2.250	2.204	2.132	1.930	1.672
28	4.196	3.340	2.947	2.714	2.558	2.445	2.359	2.291	2.236	2.190	2.118	1.915	1.654
29	4.183	3.328	2.934	2.701	2.545	2.432	2.346	2.278	2.223	2.177	2.104	1.901	1.638

(continued)