



THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. Degree Programme

OPEN ELECTIVE - LEVEL 05

ADU5319 - DESIGN AND ANALYSIS OF EXPERIMENTS

OPEN BOOK TEST 2024/2025

Duration: One Hour

Date: 15.02.2025

Time: 02.30 p.m- 03.30 p.m

Instructions:

- Statistical Tables are attached on the last page.
- Non-programmable calculators are permitted.
- Consider the level of significance as 0.05 for all the tests.

Question 01

- (a) A farmer wants to know whether four brands of insecticides say P_1 , P_2 , P_3 , and P_4 , produced by four different companies have the same effect on the yield of potatoes. Assume that the farmer has 20 homogeneous plots of land prepared for growing potatoes.
- (i) In relation to this study, identify
- Treatments
 - Experimental unit
 - Response variable
- (ii) What experimental design you would select to perform the study? Justify your answer.
- (iii) Briefly explain how you would design an experiment to solve the farmer's problem.
- (b) Instead of having 20 homogeneous plots as in part(a), if 5 lands, each containing 4 homogeneous plots are available,
- (i) What experimental design you would select to perform the study? Justify your answer.
- (ii) Briefly explain how you would design an experiment to solve the researcher's problem.

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Question 02

- (a) A researcher wanted to determine whether the 3 energy drinks *A*, *B*, and *C*, differ in their effects on endurance. Six people participated in the research and each person drinks each energy drink. The response is time to exhaustion on a treadmill. The results of the measurements are given in the following table.

Person	Drink 1	Drink 2	Drink 3
1	42	48	62
2	36	34	48
3	54	56	75
4	44	46	52
5	28	32	44
6	45	50	65

- (i) Write down the hypotheses to be tested.
- (ii) Construct the analysis of variance table.
- (iii) Test your hypotheses in part (i) and write down your conclusions.

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	2.754	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	2.620	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