The Open University of Sri Lanka

B.Sc/B.Ed. DEGREE, CONTINUING EDUCATION PROGRAMME

No Book Test - 2024/2025

Level 05 - Applied Mathematics

ADU5305/ADE5305– Statistical Inference

Duration: - One hour.

DATE: - 09 -03-2025 **Time: - 2.30 p.m. – 3.30 p.m.**

Non programmable calculators are permitted.

Answer all questions

1.

Mathematics marks at the yearend examination in grade 10 and grade 11 for randomly selected 10 students in ***ABC school*** are given below. The same teacher is teaching mathematics for grade 10 and grade 11. From the past experience it is reasonable to assume that mathematics marks in grade 10 and grade 11 follow normal distribution.

Student Name	A	B	C	D	E	F	G	H	I	J
Mathematics marks grade 10	60	47	60	56	47	27	45	61	68	62
Mathematics marks grade 11	67	54	53	49	47	35	30	77	57	54

(i) Construct 95% confidence interval for mean of the mathematics marks in grade 10.

(ii) Construct 95% confidence interval for variance of the mathematics marks in grade 10.

(iii) .Using suitable statistical test, test the validity of the claim that "Expected Mathematics mark in grade 10 is less than the expected Mathematics mark in grade 11 for a randomly selected student". Use 5% level of significance.

2.

(a) Briefly explain the terms

(i) Significance level

(ii) Power of the test

(b) In a process of a production, the production manager is interested in the proportion θ of defective items produced. Suppose a random sample of 100 items (drawn with replacement) were tested. Suppose that 6 items were defective.

(i) Construct a 95% confidence interval for θ. Interpret the results.

(ii) Comment on the claim that "95% of the produced items are not defective"

(iii) Using a suitable statistical test comment on the claim that "proportion of defective items of the production process θ is less than 0.05"

Table of $\chi^2_{\alpha,\nu}$ quantiles (χ^2 table)

df	α							
ν	0.99	0.975	0.95	0.90	0.1	0.05	0.025	0.01
1	0	0.001	0.004	0.016	2.706	3.841	5.024	6.635
2	0.02	0.051	0.103	0.211	4.605	5.991	7.378	9.21
3	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345
4	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277
5	0.554	0.831	1.145	1.61	9.236	11.07	12.833	15.086
6	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812
7	1.239	1.69	2.167	2.833	12.017	14.067	16.013	18.475
8	1.646	2.18	2.733	3.49	13.362	15.507	17.535	20.09
9	2.088	2.7	3.325	4.168	14.684	16.919	19.023	21.666
10	2.558	3.247	3.94	4.865	15.987	18.307	20.483	23.209

Let $X \sim \chi^2_\nu$ and α be a probability. This table contains the upper α quantiles $\chi^2_{\alpha,\nu}$ of the χ^2_ν distributions such that $\Pr(X > \chi^2_{\alpha,\nu}) = \alpha$. For example, $\chi^2_{0.025,10} = 20.483$.

Table of Standard Normal Probabilities

Let $Z \sim N(0,1)$. This table contains the probabilities $Pr(Z \geq z)$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1057	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143