

[Time:2.30 Hrs]

[Marks:75]

Please check whether you have got the right question paper.

- N.B:
1. All 5 questions are compulsory.
 2. All questions carry equal marks .
 3. Figures to the right indicate full marks.
 4. Use of simple calculator, statistical and log tables is permitted.
 5. Formula sheet and graph paper is provided
 6. Diagram , graph and other illustrations must be done using pen , pencil work will not be evaluated

Q.1 Attempt any one question. 15

- A. Discuss in detail about discrete distribution.
B. Elaborate on the process of statistical hypothesis testing.

Q.2 Attempt any one question. 15

- A. Illustrate various assumptions underlying MANOVA and discriminant functional analysis in detail
B. What are the assumptions of ANOVA. Compute one-way ANOVA for the following data:

Group A	Group B	Group C
4	6	8
2	8	10
4	6	4
2	10	4
6	8	2
8	6	4

Critical value at 0.05 level of significance = 3.68

Q.3 Attempt any one question. 15

- A. Discuss any three special correlations.
B. What is Spearman's RHO? Compute spearman's rank order correlation with the following data:

Group A	Group B
12	20
18	14
22	22
14	26
16	28
20	24
15	30
10	18
24	32

15

Q.4 Attempt any one question.

- A. What is factor analysis? State several assumptions, purpose , advantages and disadvantages of factor analysis
- B. Describe structural equation modelling. What are assumptions and steps of structural equation modelling?

Q.5 Write short notes (Attempt any 3 out of 4)

15

- A. Normal distribution
- B. Wilcoxon sign-rank test
- C. Computation steps of Chi square
- D. Types of factor analysis

[वेळ: २.३० तास]

[गुण:७५]

कृपया तुम्हाला योग्य प्रश्नपत्रिका मिळाली आहे का, ते तपासा.

सूचना: १. सर्व पाचही प्रश्न अनिवार्य आहेत.

२.सर्व प्रश्नांना समान गुण आहेत .

३. उजवीकडील अंक प्रश्नाचे पूर्ण गुण दर्शवितात.

४. साधे कॅल्क्युलेटर, सांख्यिकी आणि लॉग टेबल वापरण्याची परवानगी आहे.

५. फॉर्म्युला शीट आणि आलेख पेपर दिलेला आहे

६. आकृती, आलेख आणि इतर चित्रे पेन वापरून करणे आवश्यक आहे, पेन्सिलच्या कामाचे मूल्यमापन केले जाणार नाही

७.आवश्यकता असल्यास मूळ इंग्रजी प्रश्नपत्रिका पहावी.

प्र.१ कोणताही एक प्रश्न सोडवा.

१५

अ. स्वतंत्र वितरणाबद्दल सविस्तर चर्चा करा.

ब. सांख्यिकीय गृहीतक चाचणीची प्रक्रिया सविस्तरपणे सांगा.

प्र.२ कोणताही एक प्रश्न सोडवा.

१५

अ. MANOVA आणि भेदक कार्यात्मक विश्लेषणातील विविध गृहीतके सांगा आणि त्यांचे तपशीलवार वर्णन करा

ब. ANOVA ची गृहीतके काय आहेत. खालील डेटासाठी एकेरी ANOVA ची गणना करा:

गट अ	गट ब	गट क
4	6	8
2	8	10
4	6	4
2	10	4
6	8	2
8	6	4

Critical value at 0.05 level of significance = 3.68

प्र.३ कोणताही एक प्रश्न सोडवा.

१५

- अ. कोणत्याही तीन विशेष सहसंबंधांची चर्चा करा.
ब. स्पीअरमनचा RHO म्हणजे काय? खालील डेटासह स्पीअरमनचा रँक ऑर्डर सहसंबंध मोजा:

गट अ	गट ब
12	20
18	14
22	22
14	26
16	28
20	24
15	30
10	18
24	32

प्र.४ कोणताही एक प्रश्न सोडवा.

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- अ. घटक विश्लेषण म्हणजे काय? घटक विश्लेषणाचे अनेक गृहीतके, उद्देश, फायदे आणि तोटे सांगा
ब. रचनात्मक समीकरण मॉडेलिंगचे वर्णन करा. रचनात्मक समीकरण मॉडेलिंगचे गृहीतके आणि पायऱ्या काय आहेत?

प्र.५

१५

थोडक्यात टीपा लिहा (कोणत्याही तीन)

- अ. सामान्य वितरण
ब. विल्कोक्सन साईन-रँक चाचणी
क. काय वर्ग च्या गणना पायऱ्या
ड. घटक विश्लेषणाचे प्रकार

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

$$S_X^2 = \frac{\sum (X - \bar{X})^2}{n}$$

$$S_X = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$

$$S_{\bar{X}} = \frac{S_X}{\sqrt{n}}$$

$$Mdn = \left[\frac{(n+1)}{2} \right]^{th} \text{ score}$$

$$Cov_{XY} = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{n}$$

$$r = \frac{\frac{\sum (X - \bar{X})(Y - \bar{Y})}{n}}{S_X S_Y} \quad t = \frac{r\sqrt{N-2}}{\sqrt{1-r^2}}$$

$$r_{adj} = \sqrt{1 - \frac{(1-r^2)(n-1)}{n-2}}$$

$$\sum (X - \bar{X})(Y - \bar{Y}) = \sum XY - \frac{(\sum X)(\sum Y)}{n}$$

$$\tilde{\tau} = \frac{n_c - n_d}{\left[\frac{n(n-1)}{2} \right]} \quad \tilde{\tau} = 1 - \frac{2(n_s)}{n(n-1)} \quad z = \frac{\tilde{\tau}}{\sqrt{\frac{2(2n+5)}{9n(n-1)}}}$$

$$r_{Rho} = 1 - \frac{6 \sum D^2}{n(n^2 - 1)} \quad t = \frac{r_{Rho} \sqrt{n-2}}{\sqrt{1-r_{Rho}^2}}$$

$$t = \frac{(\bar{X}_A - \bar{X}_B) - (\mu_A - \mu_B)_{hypo}}{\sqrt{\frac{S_A^2}{n_A} + \frac{S_B^2}{n_B}}}$$

$$S_p^2 = \frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1 + n_2 - 2}$$

$$SS_b = \sum_{i=1}^k n_i (\bar{X}_i - \bar{\bar{X}})^2 \quad SS_T = \sum_{i=1}^n (X - \bar{\bar{X}})^2$$

$$SS_w = \sum_{\text{all scores}} (X - \bar{X})^2 \quad F = \frac{S_b^2}{S_w^2} \quad HSD = q \sqrt{\frac{S_w^2}{n}}$$

$$\chi^2 = \sum \left(\frac{(f_o - f_e)^2}{f_e} \right)$$

$$t = \frac{b_k}{SE_{b_k}} \text{ where } b_k \text{ is regression coefficient}$$

$$\Lambda = \frac{|S_{error}|}{|S_{effect} + S_{error}|} \quad \eta^2 = 1 - \Lambda$$

$$b = \frac{Cov_{xy}}{S_x^2} \quad a = \bar{Y} - b\bar{X}$$

$$s_{Y \cdot X} = \sqrt{\frac{\sum (Y - \hat{Y})^2}{n-2}} = \sqrt{\frac{SS_{Residual}}{df}}$$

$$PIP = 1 - \sqrt{1 - r^2}$$

$$Eigenvalue = \sum_{i=1}^k (b_{ij})^2 \quad f = \text{component}, f \leq k; k = \text{variable},$$

$$j = 1, 2, \dots, f; \quad i = 1, 2, \dots, k$$

$$h^2 = \sum_{j=1}^f (b_{ij})^2 \quad f = \text{component}, f \leq k; k = \text{variable},$$

$$j = 1, 2, \dots, f; \quad i = 1, 2, \dots, k$$

$$\sum (Y - \bar{Y})^2 = \sum (\hat{Y} - \bar{Y})^2 + \sum (Y - \hat{Y})^2$$

$$\tilde{n} = \frac{k}{(1/n_A) + (1/n_B) + \dots + (1/n_k)}$$

$$t = \frac{(\bar{X}_A - \bar{X}_B) - (\mu_A - \mu_B)_{\text{hypo}}}{\sqrt{S_A^2 + S_B^2 - 2rS_AS_B}}$$

$$r_p = r_{AB.C} = \frac{r_{AB} - r_{AC}r_{BC}}{\sqrt{(1-r_{AC}^2)(1-r_{BC}^2)}} \quad t = \frac{r_p \sqrt{n-v}}{\sqrt{1-r_p^2}}$$

Appendix: Statistical Tables.

Table: Area Under Normal Distribution.

For example, to determine the area under the curve between 0 and 0.45, start at the row for 0.4, and read along until 0.45 - there is the value 0.1736. Because the curve is symmetrical, the same table can be used for values going either direction, so a negative 0.45 also has an area of 0.1736.

For the Z score of .045, The area between mean and Z is .1736. the area beyond Z is .50 - .1736.

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

The studentized range statistic (q)*

*The critical values for q corresponding to alpha = .05 (top) and alpha = .01 (bottom)

df for Error Term	3	4	5
5	4.60 6.98	5.22 7.80	5.67 8.42
6	4.34 6.33	4.90 7.03	5.30 7.56
7	4.16 5.92	4.68 6.54	5.06 7.01
8	4.04 5.64	4.53 6.20	4.89 6.62
9	3.95 5.43	4.41 5.96	4.76 6.35
10	3.88 5.27	4.33 5.77	4.65 6.14
11	3.82 5.15	4.26 5.62	4.57 5.97
12	3.77 5.05	4.20 5.50	4.51 5.84
19	3.59 4.67	3.98 5.05	4.25 5.33
20	3.58 4.64	3.96 5.02	4.23 5.29
24	3.53 4.55	3.90 4.91	4.17 5.17
26	3.52 4.51	3.89 4.87	4.15 5.13
27	3.51 4.50	3.88 3.86	4.14 5.11
30	3.49 4.45	3.85 4.80	4.10 5.05
40	3.44 4.37	3.79 4.70	4.04 4.93
60	3.40 4.28	3.74 4.59	3.98 4.82
96	3.36 4.22	3.70 4.52	3.93 4.74
97	3.36 4.22	3.7 4.52	3.93 4.74
120	3.36 4.20	3.68 4.50	3.92 4.71
infinity	3.31 4.12	3.63 4.40	3.86 4.60

Table of t distribution

T table				
Df	probability (two-tailed)			
	0.05	0.01	0.005	0.001
8	2.306004	3.355387	3.832519	5.041305
9	2.262157	3.249836	3.689662	4.780913
10	2.228139	3.169273	3.581406	4.586894
20	2.085963	2.84534	3.153401	3.849516
30	2.042272	2.749996	3.029798	3.645959
50	2.008559	2.677793	2.936964	3.496013
60	2.000298	2.660283	2.914553	3.4602
70	1.994437	2.647905	2.898734	3.435015
80	1.990063	2.638691	2.886972	3.416337
90	1.986674	2.631565	2.877884	3.401935
100	1.983971	2.625891	2.870652	3.390491
110	1.981765	2.621265	2.864759	3.381179
120	1.97993	2.617421	2.859865	3.373454
130	1.97838	2.614177	2.855736	3.366942
140	1.977054	2.611403	2.852206	3.361378
145	1.97646	2.610161	2.850626	3.358889
149	1.976013	2.609228	2.849439	3.35702
150	1.975905	2.609003	2.849152	3.356569
151	1.975799	2.60878	2.84887	3.356124
inf	1.96	2.57	2.80	3.29

Table various values of F in F distribution for probability of .05 and .01.

df1 (numerator)	df2 (denominator)	Probability	
		0.05	0.01
1	8	5.317655	11.25862
1	20	4.351243	8.095958
1	26	4.225201	7.721254
1	36	4.1132	7.395663
2	5	5.786135	13.27393
2	13	3.805565	6.700965
2	14	3.738892	6.514884
2	15	3.68232	6.358873
2	17	3.591531	6.112114
2	27	3.354131	5.488118
2	28	3.340386	5.452937
2	29	3.327654	5.420445
2	174	3.04	4.75
2	176	3.04	4.72
3	9	3.862548	6.991917
3	36	2.866266	4.377096
3	37	2.858796	4.35954
3	38	2.851741	4.342988
8	288	1.97063	2.5743

Chi-square Table			
df	Probability		
	0.05	0.01	0.005
1	3.841459	6.634897	7.879439
2	5.991465	9.21034	10.59663

$e^{-\lambda}$ values

λ	1	2	3	4	5	6	7	8
$e^{-\lambda}$	0.367879	0.135335	0.049787	0.018316	0.006738	0.002479	0.000912	0.000335

Pearson's r significance table

Df	1	2	3	4	5	6	7	8	9	10
0.05	0.997	0.95	0.878	0.811	0.754	0.707	0.666	0.632	0.602	0.576
0.01	0.9999	0.99	0.959	0.917	0.874	0.834	0.798	0.765	0.735	0.708
