

[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. Describe the process of statistical hypothesis testing
- B. Describe descriptive statistics. Elaborate on testing for normality and outliers.

Q.2 Attempt **any one** question. 15

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

Group A	Group B	Group C
6	5	7
3	5	3
7	9	7
1	4	1
3	3	5
5	5	5

Q.3 Attempt **any one** question. 15

- A. Describe in detail measures for nominal data.
- B. What are the assumptions of chi square? Compute chi square for the following data:

Gender	Internet Addiction	
	High	Low
Male	50	60
Female	40	30

Q.4 Attempt **any one** question. 15

- A. What is factor analysis? Describe in detail various types of factor analysis.
- B. Describe structural equation modelling. What are its limitations?

Q.5 Write short notes (Attempt **any 3 out of 4**) 15

- A. Conditions for Poisson Distribution
- B. Assumptions of Discriminant Functional Analysis (DFA)
- C. Conditions to be met for using Regression Analysis
- D. Assumptions of structural equation modelling

[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. सांख्यिकीय गृहीतक चाचणी प्रक्रियेचे वर्णन करा.

ब. वर्णनात्मक आकडेवारीचे वर्णन करा. सामान्यता आणि आउटलियर्सच्या चाचणीबद्दल तपशीलवार सांगा.

प्र.२ कोणताही एक प्रश्न सोडवा.

१५

अ. MANOVA आणि भेदभावपूर्ण 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
6	5	7
3	5	3
7	9	7
1	4	1
3	3	5
5	5	5

प्र.३ कोणताही एक प्रश्न सोडवा.

१५

अ. नाममात्र श्रेणीसाठी मोजमापानाचे तपशीलवार वर्णन करा.

ब. काय वर्गाची गृहीतके सांगा. खालील डेटासाठी काय स्क्वेअरची गणना करा:

Gender	Internet Addiction	
	High	Low
Male	50	60
Female	40	30

- प्र.४ कोणताही एक प्रश्न सोडवा. १५
- अ. घटक विश्लेषण म्हणजे काय? विविध प्रकारच्या घटक विश्लेषणाचे तपशीलवार वर्णन करा.
- ब. संरचनात्मक समीकरण मॉडेलिंगचे वर्णन करा. त्याच्या मर्यादा काय आहेत?
- प्र.५ थोडक्यात टीपा लिहा (कोणत्याही तीन) १५
- अ. पॉइसॉन वितरणासाठी अटी
- ब. भेदभाव कार्यात्मक विश्लेषण (DFA) च्या गृहीतके
- क. प्रतिगमन विश्लेषण वापरण्यासाठी पूर्ण कराव्या लागणाऱ्या अटी
- ड. स्ट्रक्चरल समीकरण मॉडेलिंगचे गृहितक
-

Formula Sheet

$$SSx = \sum x^2 - \frac{(\sum x)^2}{n_x}$$

$$SSy = \sum y^2 - \frac{(\sum y)^2}{n_y}$$

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{\left(\frac{SSx + SSy}{(n_x - 1) + (n_y - 1)} \right) \left(\frac{1}{n_x} + \frac{1}{n_y} \right)}}$$

$$S_{\bar{x}} = \frac{S_x}{\sqrt{n}}$$

$$S_{\bar{y}} = \frac{S_y}{\sqrt{n}}$$

$$S_{\bar{x} - \bar{y}} = \sqrt{S_{\bar{x}}^2 + S_{\bar{y}}^2 - 2r S_{\bar{x}} S_{\bar{y}}}$$

$$t = \frac{\bar{x} - \bar{y}}{S_{\bar{x} - \bar{y}}}$$

$$SSw = \sum (x - \bar{x})^2$$

$$SSbet = \sum n_i (\bar{x}_i - \bar{x})^2$$

$$df \text{ within} = n_{total} - k$$

$$df \text{ bet} = k - 1$$

$$df \text{ total} = dfw + dfbet.$$

$$S^2 \text{ within} = \frac{SSw}{dfw}$$

$$S^2 \text{ bet} = \frac{SSbet}{dfbet}$$

$$F = \frac{S^2 \text{ bet}}{S^2 \text{ within}}$$

$$S_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

$$S_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n}}$$

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{n S_x S_y}$$

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

Formula Sheet

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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
