RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

SECOND YEAR B.A./B.SC. FOURTH SEMESTER (January – June) 2014 Mid-Semester Examination, March 2014

Date : 25/03/2014

STATISTICS (General)

Time : 11 am – 12 noon

Paper : IV

Full Marks : 25

[Use a separate Answer Book for each group]

<u>Group – A</u>

1. Answer **any one** question :

- a) i) Write down the model for analysis of one-way classified data, stating clearly the assumptions required, null & alternative hypothesis. [2]
 - ii) For examining the effects of 5 fertilisers on the field of wheat, an experimenter divided the field into 35 plots & assigned each fertiliser to 7 plots at random. Part of his calculations are shown below :

Source of variation	df	SS	MS	F	F _{0.05}
Fertilisers			720		
Error					
Total		6420			

After completing the above table, test at 5% level of significance whether the fertilisers differ significantly.

- b) i) Explain the basic principles of design of experiments.
 - ii) Using the random number table provided, prepare the layout of a CRD (Completely Randomised Design) with treatments A, B, C, D, E and their corresponding replications provided as follows :
 - A & B : each replicated 4 times
 - C : Replicated 5 times
 - D&E : each replicated 7 times

2. Answer <u>any one</u> question :

a) A laboratory technician measures the breaking strength of each of five kinds of linen threads by using four (4) different measuring instruments, I₁, I₂, I₃ & I₄ and obtains the following results, in ounces :

	I_1	I_2	I_3	I_4
Thread 1	20.9	20.4	19.9	21.9
Thread 2	25	26.2	27	24.8
Thread 3	25.5	23.1	21.5	24.4
Thread 4	24.8	21.2	23.5	25.7
Thread 5	19.6	$21 \cdot 2$	22.1	$22 \cdot 1$

Perform a two-way ANOVA, using 0.05 level of significance for both tests.

b) To compare the productivity of 4 varieties of wheat v_1 , v_2 , v_3 and v_4 in a completely randomised design with replication numbers 4, 3, 3, 2 respectively for the four varieties, a homogeneous plot of land was chosen and in it 12 equal square areas were marked and the seeds of the varieties were sown at random in these areas. The fields (in suitable units) are shown below in brackets along with the varieties of wheat.

Analyze the data and give your comments :

 $v_2(30.6), v_3(27.7), v_1(27.8), v_1(27.3), v_4(16.2), v_2(28.8), v_4(15.0), v_3(24.7), v_1(28.5), v_2(31.0), v_1(30.5), v_3(26.0)$ [10]

[10]

[2]

[3]

[3]

<u>Group – B</u>

3. Answer **any one** question :

a)	i)	What is a modified exponential curve? Describe a procedure for estimating the parameters	of
		such a curve.	[3+3]

	ii) Fit ar	1 exponentia	al trend to the fo	ollowing data :				
	Year	: 200	05 2006	2007	2008	2009	2010	
	Value	e : 23,4	01 25,083	28,579	34,157	35,263	38,773	[4]
b)	Obtain se	asonal indic	es by the metho	od of trend ratio	s, assumi	ing a linear t	rend.	
	Year	Quarter	I Quarter I	I Quarter	III	Quarter IV		
	2008	1,336	1,065	1,215	5	1,335		
	2009	1,463	1,039	1,183	3	1,161		
	2010	1,306	1,041	1,290)	1,321		
	2011	1,525	1,251	1,450	5	1,408		[10]

V'	15.,	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞ ()
	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251-1	252.2	253-3	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	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10-13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.6.
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.30
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.6
7	5.59	4.74	4.35.	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.2.
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.9
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.7
0	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.5
1	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.4
2	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.3
3	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.2
4	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.1
5	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.0
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.0
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.9
8	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1-97	1-9
9	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.8
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2:35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.8
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1-84	1.7
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1-84	1.79	1.7
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1-99	1.95	1.90	1.85	1.80	1.75	1.6
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1-96	1.91	1.87	1.82	1.77	1.71	1.6
80	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1-93	1.89	1.84	1.79	1.74	1.68	1.6
10	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.5
50	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1-99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1-3
20	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.2
00	3.84	3.00	/ 2.60	2.37	2.21	- 2.10	2.01	1.94	1.88	1-83	1.75	1.67	1.57	J-52	1.46	1:39	1.32	- 1.22	1.0

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TABLE Value values of A and And And And And TABLE V. (Contd.), and for as the substance value																		
1.81) (E)		.3.93	150	- 5-10	3:01	Value	es of	$F_{.01 : v}$	I. V2	1.03	1.2.1	1.25	1-10	1.18	est all		1 Cape
1 0 3 1 0 3	2	3 38	412	5 (10) - 3 (3) 7 (4)	6	700	8 0 4 0 10 1 10	9	10	12 43	15	20	24	30	40	60	120	~
4052 49	999.5 5	403 5	625 5	764 5	859 5	928 5	982 6	022 6	056 6	106 6	157 6	209 6	235 6	261 6	287 6	313 6	339 6	366
98.50	99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39	99.40	99.42	99.43	99.45	99.46	99.47	99.47	99.48	99.49	99.50
34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35	27.23	27.05	26.87	26.69	26.60	26.50	26.41	26.32	26.22	26.13
21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.37	14.20	14.02	13.93	13.84	13.75	13.65	13.56	13.46
10.20	13.27	12.00	0.15	10.97	10.07	0.26	10.29	10.10	10.05	9.89	9.12	9.55	9.47	9.38	9.29	9.20	9.11	9.02
13:75	0.55	9.10	7.05	7.46	7.10	6.00	6.94	6.72	6.62	6.17	6.21	6.16	6.07	1.2.5	7.14	7.00	6.91	6.88
11.26	9.55	7.50	7.01	6.63	6.37	6.19	6.03	5.01	5.91	5.67	5.52	5.26	5.20	5.20	5.12	5.02	5.14	2.02
10.56	8.02	6.00	6.47	6.06	5.80	5.61	5.47	5.35	5.26	5.11	1.06	1.81	1.73	1.65	1.57	3.05	4.40	4.80
10.04	7.56	6.55	5.00	5.64	5.30	5.20	5.06	4.94	4.85	4.71	4.56	4.01	4.33	4.0.5	4.17	4.40	4.40	3.01
9.65	7.21	6.22	5.67	5.37	5.07	4.89	4.74	4.63	4.54	4.40	4.25	4.10	4.02	3.04	3.86	2.78	3.60	3.60
9.33	6.93	5.95	5.41	5.06	4.87	4.64	4.50	4.39	4.30	4.16	4.01	3.86	3.78	3.70	3.67	3.54	3.45	3.36
9.07	6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10	3.96	3.87	3.66	3.59	3.51	3.43	3.34	3.25	3.17
8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94	3.80	3.66	3.51	3.43	3.35	3.77	3.18	3.09	3.00
8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.67	3.52	3.37	3.29	3.21	3.13	3.05	2.96	7.87
8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.55	3.41	3.26	3.18	3.10	3.02	2.93	2.84	2.75
8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.46	3.31	3.16	3.08	3.00	2.92	2.83	2.75	2.65
8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.60	3.51	3.37	3.23	3.08	3.00	2.92	2.84	2.75	2.66	2.57
8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.30	3.15	3.00	2.92	2.84	2.76	2.67	2.58	2.49
8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.23	3.09	2.94	2.86	2.78	2.69	2.61	2.52	2.42
7.95	5.72	4.82	4.31	. 3.99	3.76	3.59	3.45	3.35	3.26	3.12	2.98	2.83	2.75	2.67	2.58	2.50	2.40	2.31
7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.03	2.89	2.74	2.66	2.58	2.49	2.40	2.31	2.21
7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09	2.96	2.81	2.66	2.58	2.50	2.42	2.33	2.23	2.13
7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.90	2.75	2.60	2.52	2.44	2.35	2.26	2.17	2.06
7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.84	2.70	2.55	2.47	2.39	2.30	2.21	2.11	2.01
7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.66	2.52	2.37	2.29	2.20	2.11	2.02	1.92	1.80
7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.50	2.35	2.20	2.12	2.03	1.94	1.84	1.73	1.60
6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.34	2.19	2.03	1.95	1.86	1.76	1.66	1.53	1.38
6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.18	2.04	1.88	1.79	1.70	1.59	1.47	1.32	1.00
	1 4052 4 98:50 34:12 21:20 16:26 13:75 12:25 11:26 10:06 10:06 10:04 9:65 9:33 9:07 8:86 8:68 8:53 8:40 8:29 8:18 8:10 7:95 7:82 7:72 7:64 7:56 7:31 7:08 6:85 6:63	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Value1234567840524999.5540356255764585959285982698.5099.0099.1799.2599.3099.3399.3699.3734.1230.8229.4628.7128.2427.9127.6727.4921.2018.0016.6915.9815.5215.2114.9814.8016.2613.2712.0611.3910.9710.6710.4610.2913.7510.929.789.158.758.478.268.1012.259.558.457.857.467.196.996.8411.268.657.597.016.636.376.186.0310.658.026.996.426.065.805.615.4710.047.566.555.995.645.395.205.069.657.216.225.675.325.074.894.749.336.935.955.415.064.824.644.509.076.705.745.214.864.624.444.308.866.515.565.044.694.464.284.148.886.365.424.894.564.324.144.008.536.235.294.774.444.204.033.898.406.115.184.67 <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{ c c c c c c c c c c c c c c c c c c c$</td>	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$					

TABLE VI

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	Sector Sector	KANDUN	1 SAMPI	TING IND	MDEKS	The second second	
4652	3819	8431	2150	2352	2472	0043	3488
9031	7617	1220	4129	7148	1943	4890	1749
2030	2327	7353	6007	9410	9179	2722	8445
0641	1489	0828	0385	8488	0422	7209	4950
8479	6062	5593	6322	9439	4996	1322	4918
9917	3490	5533	2577	4348	0971	2580	1943
6376	9899	9259	5117	1336	0146	0680	4052
7287	0983	3236	3252	0277	8001	6058	4501
0592	4912	3457	8773	5146	2519	3931	6794
6499	9118	3711	8838	0691	1425	7768	9544
0769	1109	7909	4528	8772	1876	2113	4781
8678	4873	2061	1835	0954	5026	2967	6560
0178	7794	6488	7364	4094	1649	2284	7753
3392	0963	6364	5762	0322	2592	3452	9002
0264	6009	1311	5873	5926	8597	9051	8995
4089	7732	8163	2798	1984	1292	0041	2500
9376	7365	7987	1937	2251	3411	6737	0367
3039	3780	2137	7641	4030	1604	2517	9211
8971	8653	1855	5285	5631	2649	6696	5475
0373	4153	5199	5765	2067	6627	3100	5716
9092	4773	0002	7000	7800	2292	2933	6125
2464	1038	3163	3569	7155	2029	2538	7080
3027	6215	3125	5856	9543	3660	0255	5544
5754	9247	1164	3283	1865	5274	5471	1346
4358	3716	6949	8502	1573	5763	5046	7135
7178	8324	8379	7365	4577	4864	0629	5100
5035	5939	3665	2160	6700	7249	1738	2721
3318	0220	3611	9887	4608	8664	2185	7290
9058	1735	7435	6822	6622	8286	8901	5534
7886	5182	7595	0305	4903	3306	8088	3899
3354	8454	7386	1333	5345	6565	3159	3991
3415	7671	0846	7100	1790	9449	6285	2525
3918	5872	7898	6125	2268	1898	0755	6034
6138	9045	6950	8843	6533	0917	6673	5721
3825	1704	2835	4677	4637	7329	3156	3291
1349	0417	9311	9787	1284	0769	8422	1077
4234	0248	7760	6504	2754	4044	0842	9080
6880	3201	7044	3657	5263	0374	7563	6599
0714	5008	5076	1134	5342	1608	5179	0967
3448	6421	3304	0583	1260	0662	7257	0766
5711	7343	7539	3684	9397	5335	4031	1486
2588	3301	0553	2427	3598	2580	7017	9176
8581	4253	7404	5264	5411	3431	3092	8573
8475	6322	3949	9675	6533	1133	8776	2216
0272	5624	8549	5552	7469	2799	2822	9620
7383	7795	7939	2652	4456	6993	2950	8573
5126	2089	7729	0945	3901	4445	7117	8186
2064	3760	0939	7319	5939	3432	2030	4752
9315	8185	7805	6294	7072	6491	4012	1016
6814	8752	3462	6001	3302	3895	7371	3432

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	4433 9193 4246	0247 7314 0693	9747 1501 6041	0412 4702 0931	3893 7030 2952	2503 9601 4968	2972 0630 8239	4154 3727 7729
	6974 5673	1051 1602	8966 8741	5157 0513	2154 8713	9558 6108	7646 7329	3043 7698
	7370 6934 1592	7319 0165 6953	4104 3319 7868	6025 6222 5874	4209 4129 0805	5042 6524 1138	4501 4322 9428	7824 9422 0189
	4683 4206	7249 3295	1998 1732	0956 6780	8325 8409	4001 6957	2261 5292	8844 5041
	5885 2584 1275	3316 4222 5976	1187 9438 4273	1217 9652 4895	3912 0338 5751	9712 3112	7220 8715 5082	0035 9587 6050
	6801 6853	1709 9282	0038	1231 0347	5222 3135	2473 5902	8909 2384	9970 7929
	1684 2391	4343 5742 2897	1897 3406	2503 4844	1656 8756	5702 8011	4613 0246	4108 3663
	2543 6793	3913 5986	1429 8153	6379 0769	3369 3347	9040 4014	5983 7007	0436 9018
	4970 4496	2717 1109	9943 8238	1136 9173	9504 6244	0519 7230	5240 0991	0929 0991 1463
	9022 4816	5050 1007	5383 1067	9582 2866 2266	1326 7916	2516 2674	5578 2675	4051 1675
	4234 6933	7491 5786	8194 6675	5072 7853	6555 8325	0799 9408	1940 3252	1232 6799
	0502 6440	3633 9450	8896 8570	1529	4067 7718	5459 4849	3192	3247 5958
	3110 8822	1168 3604	6046 7844	5837	6243 7923	6745 7979	2362 0648	7710 9003
	8680 5327	1201	2536 9502	0308	8733 9894 0516	9722 0438	4556 2677	4684 9200 5552
	2688 8552	7601 8348	3408 7934	6525 1530	2710 3523	4547 6882	9156 4334	1623 7237
	8/13 2104	5638 4716 8400	7582	3148 4576 2200	4508 8105	5123	4023 9082	2426
	0085	0711 3407	9557 5603	8428 5431	4332 0083	9685 7074	6492 6929	7422 7054
	2193 5392	9184	4815	0566 4578	1214 5107	8483 7946	4502	2765
	0495	3715	6053 3040	1723 0852	0114 2939	8257 4015	4650 6927	9901 7710
	3132	2603	5574	1528	8104	5520	7279	3750 7940

TABLE VI (Contd.)

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