WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 6th Semester Examination, 2021

BOTADSE06T-BOTANY (DSE3/4)

BIOSTATISTICS

Time Allotted: 2 Hours

Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words
and adhere to the word limit as practicable.

প্রান্তিক সীমার মধ্যস্থ সংখ্যাটি পূর্ণমান নির্দেশ করে।
পরীক্ষার্থীরা নিজের ভাষায় যথা সম্ভব শব্দসীমার মধ্যে
উত্তর করিবে।

1. Answer the following questions briefly: 1×16 = 16
    (a) How does a sample differ from a population?
    (b) Define geometric mean.
    (c) What do you mean by the term 'central tendency'?
    (d) State the different types of data collection procedure.
    (e) The mean of 6 observations is 17.5. If five of them are 14, 9, 23, 25 and 10, find the sixth observation.
    (f) Define 'Null Hypothesis'.
    (g) State the merits of Mode.
    (h) What do the term 'degrees of freedom' mean?
    (i) If the mean of observations $A_1, A_2, A_3 \ldots \ldots A_n$ is $\overline{A}$, which is the mean of new observations, when data are $A_1 + a, A_2 + a, A_3 + a \ldots \ldots A_n + a$

    (i) $a\overline{A}$ (ii) $\overline{A} + a$ (iii) $\overline{A} - a$ (iv) $\overline{A} / a$
    (j) State the different methods of data presentation.
    (k) What are the measures of dispersion?
    (l) What do you mean by student 't' test?
    (m) If the mean of x_1, x_2 is 7.5 and the mean of x_1, x_2, x_3 is 8, then the value of x_3 is-

    (i) 9   (ii) 8   (iii) 7.5   (iv) 6
    (n) What is meant by 'regression of y on x'?
    (o) Give the formula for χ^2 statistic.
    (p) Write the formula of median when the number of observation is f and f is even.

1

2. Answer any *eight* questions from the following: $3 \times 8 = 24$

(a) Differentiate between histogram and bar diagram.

(b) What is a continuous variable? How does it differ from a discrete one?

(c) Mention merits and demerits of standard deviation.

(d) Critically compare correlation and regression.

(e) A study of the yield of 150 tomato plants resulted in the following record. Calculate the mean of the number of tomatoes per plant-

Tomatoes per plant	1-5	6-10	11-15	16-20	21-25
Number of pants	20	50	46	22	12

(f) If the numbers 11, 13, 15, 19, $p + 2$, $p + 4$, 30, 35, 39, 46 are in ascending order and their median is 25, calculate the value of p.

(g) The mean of the following distribution is 52 and the frequency of class interval 30-40 is f. Find the value of f.

10-20	20-30	30-40	40-50	50-60	60-70	70-80
5	3	f	7	2	6	13

(h) In a seed sample analysis, the following observations are found:

Brown large seed = 57

Brown small seed = 18

Yellow large seed = 18

Yellow small seed = 7

Determine the χ^2 value of the sample.

(i) The panicle length of two wheat varieties are recorded as follows:

Variety A	25	23	26	25	22	26	23	21	26	25
Variety B	22	24	29	24	23	18	19	23	24	19

Test whether the two varieties differ in respect to their character?
[use student's t test]

(j) What do you mean by tests of significance? What are the applications of χ^2 test in genetics?

(k) The following results were obtained for calculation the coefficient of correlation between the two variables i.e., x and y from 25 pairs of observations: [$\Sigma x = 125$, $\Sigma y = 100$, $\Sigma x^2 = 650$, $\Sigma y^2 = 460$, $\Sigma xy = 508$]. State the significance level of the correlation coefficient of the two variables.

(l) Graphically explain the following equation:
$$y = \alpha + \beta x$$

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

——x——

2

BIOSTATISTICAL TABLES

Table I : Distribution of t					
Probability, p					
Degrees of freedom (n)	.2	1	.05	.02	.01	.001
---	---	---	---	---	---	---
1	3.078	6.314	12.606	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.924
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.869
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.408
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291

Table I is abridged from Table III of Fisher & Yates : *Statistical Tables for Biological, Agricultural and Medical Research*

Degrees of freedom, n_2	Degrees of freedom, n_1									
	1	2	3	4	5	6	8	12	24	∞
1	405	500	540	563	576	586	598	611	632	637
2	998.5	999.0	999.2	999.2	999.3	999.3	999.4	999.4	999.5	999.5
3	167.0	148.5	141.1	137.1	134.6	132.8	130.6	128.3	125.9	123.5
4	74.1	61.3	56.2	53.4	51.7	50.5	49.0	47.4	45.8	44.1
5	47.2	37.1	33.2	31.1	29.8	28.8	27.6	26.4	25.1	23.8
6	35.5	27.0	23.7	21.9	20.8	20.0	19.0	18.0	16.9	15.8
7	29.3	21.7	18.8	17.2	16.2	15.5	14.6	13.7	12.7	11.7
8	25.4	18.5	15.8	14.4	13.5	12.9	12.0	11.2	10.3	9.3
9	22.9	16.4	13.9	12.6	11.7	11.1	10.4	9.6	8.7	7.8
10	21.0	14.9	12.6	11.3	10.5	9.9	9.2	8.5	7.6	6.8
11	19.7	13.8	11.6	10.4	9.6	9.1	8.4	7.6	6.9	6.0
12	18.6	13.0	10.8	9.6	8.9	8.4	7.7	7.0	6.3	5.4
13	17.8	12.3	10.2	9.1	8.4	7.9	7.2	6.5	5.8	5.0
14	17.1	11.8	9.7	8.6	7.9	7.4	6.8	6.1	5.4	4.6
15	16.6	11.3	9.3	8.3	7.6	7.1	6.5	5.8	5.1	4.3
16	16.1	11.0	9.0	7.9	7.3	6.8	6.2	5.6	4.9	4.1
17	15.7	10.7	8.7	7.7	7.0	6.6	6.0	5.3	4.6	3.9
18	15.4	10.4	8.5	7.5	6.8	6.4	5.8	5.1	4.5	3.7
19	15.1	10.2	8.3	7.3	6.6	6.2	5.6	5.0	4.3	3.5
20	14.8	10.0	8.1	7.1	6.5	6.0	5.4	4.8	4.2	3.4
21	14.6	9.8	7.9	7.0	6.3	5.9	5.3	4.7	4.0	3.3
22	14.4	9.6	7.8	6.8	6.2	5.8	5.2	4.6	3.9	3.2
23	14.2	9.5	7.7	6.7	6.1	5.7	5.1	4.5	3.8	3.1
24	14.0	9.3	7.6	6.6	6.0	5.6	5.0	4.4	3.7	3.0
25	13.9	9.2	7.5	6.5	5.9	5.5	4.9	4.3	3.7	2.9
26	13.7	9.1	7.4	6.4	5.8	5.4	4.8	4.2	3.6	2.8
27	13.6	9.0	7.3	6.3	5.7	5.3	4.8	4.2	3.5	2.8
28	13.5	8.9	7.2	6.3	5.7	5.2	4.7	4.1	3.5	2.7
29	13.4	8.9	7.1	6.2	5.6	5.2	4.6	4.1	3.4	2.6
30	13.3	8.8	7.1	6.1	5.5	5.1	4.6	4.0	3.4	2.6
40	12.6	8.3	6.6	5.7	5.1	4.7	4.2	3.6	3.0	2.2
60	12.0	7.8	6.2	5.3	4.8	4.4	3.9	3.3	2.7	1.9
120	11.4	7.3	5.8	5.0	4.4	4.0	3.6	3.0	2.4	1.5
∞	10.8	6.9	5.4	4.6	4.1	3.7	3.3	2.7	2.1	1.0

Table IV is taken from Fisher and Yates : *Statistical Tables for Biological, Agricultural and Medical Research*, Published by Oliver & Boyd, Edinburgh.

Table V : Distribution of χ²

Probability, p

Degrees of freedom (n)	.99	.98	.95	.90	.80	.50	.20	.10	.05	.02	.01	.001
1	.0¹157	.0⁶628	.00393	.0158	.0642	.455	1.642	2.706	3.841	5.412	6.635	10.827
2	.0201	.0404	.103	.211	.446	1.386	3.219	4.605	5.991	7.824	9.210	13.815
3	.115	.185	.352	.584	1.005	2.366	4.642	6.251	7.815	9.837	11.345	16.266
4	.297	.429	.711	1.064	1.649	3.357	5.989	7.779	9.488	11.668	13.277	18.467
5	.554	.752	1.145	1.610	2.343	4.351	7.289	9.236	11.070	13.388	15.086	20.515
6	.872	1.134	1.635	2.204	3.070	5.348	8.558	10.645	12.592	15.033	16.812	22.457
7	1.239	1.564	2.167	2.833	3.822	6.346	9.803	12.017	14.067	16.622	18.475	24.322
8	1.646	2.032	2.733	3.490	4.594	7.344	11.030	13.362	15.507	18.168	20.090	26.125
9	2.088	2.532	3.325	4.168	5.380	8.343	12.242	14.684	16.919	19.679	21.666	27.877
10	2.558	3.059	3.940	4.865	6.179	9.342	13.442	15.987	18.307	21.161	23.209	29.588
11	3.053	3.609	4.575	5.578	6.989	10.341	14.631	17.275	19.675	22.618	24.725	31.264
12	3.571	4.178	5.226	6.304	7.807	11.340	15.812	18.549	21.026	24.054	26.217	32.909
13	4.107	4.765	5.892	7.042	8.634	12.340	16.985	19.812	22.362	25.472	27.688	34.528
14	4.660	5.368	6.571	7.790	9.467	13.339	18.151	21.064	23.685	26.873	29.141	36.123
15	5.229	5.985	7.261	8.547	10.307	14.339	19.311	22.307	24.996	28.259	30.578	37.697
16	5.812	6.614	7.962	9.312	11.152	15.338	20.465	23.542	26.296	29.633	32.000	39.252
17	6.408	7.255	8.672	10.085	12.002	16.338	21.615	24.769	27.587	30.995	33.409	40.790
18	7.015	7.906	9.390	10.865	12.857	17.338	22.760	25.989	28.869	32.346	34.805	42.312
19	7.633	8.567	10.117	11.651	13.716	18.338	23.900	27.204	30.144	33.687	36.191	43.820
20	8.260	9.237	10.851	12.443	14.578	19.337	25.038	28.412	31.410	35.020	37.566	45.315
21	8.897	9.915	11.591	13.240	15.445	20.337	26.171	29.615	32.671	36.343	38.932	46.797
22	9.542	10.600	12.338	14.041	16.314	21.337	27.301	30.813	33.924	37.659	40.289	48.268
23	10.196	11.293	13.091	14.848	17.187	22.337	28.429	32.007	35.172	38.968	41.638	49.728
24	10.856	11.992	13.848	15.569	18.062	23.337	29.553	33.196	36.415	40.270	42.980	51.179
25	11.524	12.697	14.611	16.473	18.940	24.337	30.675	34.382	37.652	41.566	44.314	52.620
26	12.198	13.409	15.379	17.292	19.820	25.336	31.795	35.563	38.885	42.856	45.642	54.052
27	12.879	14.125	16.151	18.114	20.703	26.336	32.912	36.741	40.113	44.140	46.963	55.476
28	13.565	14.847	16.928	18.939	21.588	27.336	34.027	37.916	41.337	45.419	48.278	56.893
29	14.256	15.574	17.708	19.768	22.475	28.336	35.139	39.087	42.557	46.693	49.588	58.302
30	14.953	16.306	18.493	20.599	23.364	29.336	36.250	40.256	43.773	47.962	50.892	59.703

Table VI : Value of the Correlation Coefficient (r) for different levels of significance

Degrees of freedom (n)	.1	.05	.02	.01	.001
1	.98769	.99692	.999507	.999877	.9999988
2	.90000	.95000	.98000	.990000	.99900
3	.8054	.8783	.93433	.95873	.99116
4	.7293	.8114	.8822	.91720	.97406
5	.6694	.7545	.8329	.8745	.95074
6	.6215	.7067	.7887	.8343	.92493
7	.5822	.6664	.7498	.7977	.8982
8	.5494	.6319	.7155	.7646	.8721
9	.5214	.6021	.6851	.7348	.8471
10	.4973	.5760	.6581	.7079	.8233
11	.4762	.5529	.6339	.6835	.8010
12	.4575	.5324	.6120	.6614	.7800
13	.4409	.5139	.5923	.6411	.7603
14	.4259	.4973	.5742	.6226	.7420
15	.4124	.4821	.5577	.6055	.7246
16	.4000	.4683	.5425	.5897	.7084
17	.3887	.4555	.5285	.5751	.6932
18	.3783	.4438	.5155	.5614	.6787
19	.3687	.4329	.5034	.5487	.6652
20	.3589	.4227	.4921	.5368	.6542
25	.3233	.3809	.4451	.4869	.5974
30	.2960	.3494	.4093	.4487	.5541
35	.2746	.3246	.3810	.4182	.5189
40	.2573	.3044	.3578	.3932	.4896
45	.2428	.2875	.3384	.3721	.4648
50	.2306	.2732	.3218	.3541	.4433
60	.2108	.2500	.2948	.3248	.4078
70	.1954	.2319	.2737	.3017	.3799
80	.1829	.2172	.2565	.2830	.3568
90	.1726	.2050	.2422	.2673	.3375
100	.1638	.1946	.2301	.2540	.3211