



ALUPE UNIVERSITY
COLLEGE

Bastion of Knowledge...

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**OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH**

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION

COURSE CODE: STA 300

COURSE TITLE: BIostatISTICS

DATE: 08/06/2022

TIME: 9.00AM – 12.00PM

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

PLEASE TURN OVER

STA 300
REGULAR – MAIN EXAM
STA 300: BIostatISTICS

STREAM: EDU

DURATION: 3 Hours

INSTRUCTION TO CANDIDATES

Answer **ALL** questions from section A and any **THREE** from section B.

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SECTION A [31 Marks]. Answer ALL questions.

QUESTION ONE [15 Marks]

- a) Distinguish between the following terms
- i) Primary and secondary data [2 Marks]
 - ii) Qualitative and quantitative variables [2 Marks]
 - iii) Type I and Type II error [2 Marks]
- b) Given the following data on temperature readings from an experiment, construct an ogive

Class	1-5	6-10	11-15	16-20	21-25	26-30	31-35	
Freq	2	8	18	13	7	1	1	[3 Marks]

- c) State whether each of the following observations is nominal or ordinal data. [2 Marks]
- i) The marital status of participants in a study
 - ii) The students degree classification during graduation
- d) Estimate the lower quartile, 4th decile and the 72nd percentile for the frequency table below [4 Marks]

Class	1-4	5-8	9-12	13-16	17-20	21-24	
Frequency	10	14	20	16	12	8	

QUESTION TWO [16 Marks]

- a) Given the following frequency distribution

Class	5-9	10-14	15-19	20-24	25-29	30-34	35-39
Freq	5	12	32	40	16	9	6

Compute;

- i) Mean [2 Marks]
 - ii) Median [3 Marks]
 - iii) Mode [3 Marks]
- b) Give two properties that a binomial probability distribution must fulfill [2 Marks]
- c) Cite two events that follow Poisson distribution [2 Marks]
- d) State two desirable properties of a good as measure of central tendency [2 Marks]
- e) What are some of the merits of mean over the other measures of central tendency? [2 Marks]

SECTION B [39 Marks] Answer any THREE questions]

QUESTION THREE [13 Marks]

- a) In a surveillance survey conducted in order to establish the proportion of the animal which were infected with East Coast Fever (ECF). The results indicated that 40% of them were suffering from the disease. A sample of six animals was later taken and examined for the disease. Find the probability that the following animals had the disease;
- i) Only one [2 Marks]
 - ii) Exactly two [2 Marks]
 - iii) At most two [3 Marks]
- b) In a computer system with poisson job arrival stream in at an average of two per minute, determine the probability that in any one-minute interval there will be;
- i) Exactly two jobs [2 Marks]
 - ii) At most three arrivals [4 Marks]

QUESTION FOUR [13 Marks]

- a) The following data shows the age at diagnosis of type II diabetes in young adults. Is the age at diagnosis different for males and females? [$\alpha = 0.05$] [5 Marks]
- | | | | | | |
|---------|----|----|----|----|----|
| Males | 19 | 22 | 16 | 29 | 24 |
| Females | 20 | 11 | 17 | 12 | |
- b) Consider the following figures give shoot lengths measured in m millimeters of ten randomly selected tree nurseries in village Q.
- 21.8, 24.8, 27.3, 29.3, 30.8, 31.8, 32.8, 32.5, 32.1, 31.3

On the basis of this data, test whether the shoot lengths is greater than 30mm [Use $\alpha = 0.01$] [8 Marks]

QUESTION FIVE [13 Marks]

- a) When is Kruskal-Wallis test used? Give its expression for test statistic [3 Marks]
- b) In an experiment, leaves of certain plants in the genus *Albizzia* will fold and unfold in various light conditions. Fifteen different leaves were subjected to red light for three minutes. The leaflet angles were then measured after 30, 45 and 60 minutes after light exposure in the three groups as shown below.

Delay (minutes)	Angle (degrees)				
30	140	138	140	138	142
45	140	150	120	128	130
60	118	130	128	118	118

Analyze these data to test the null hypothesis at $\alpha = 0.05$ level of significance that delay after exposure does not affect leaflet angle. [10 Marks]

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725

QUESTION SIX [13 Marks]

a) What do you understand by the term regression analysis? [2 Marks]

b) Suppose scores made by students in a biostatistics class in the mid-term and final examination are as given in the table below.

End of semester examination	90	74	98	88	80	62	78	74	86	80
CAT	98	66	100	96	88	45	76	60	74	82

Using the above data;

- Develop a regression equation which may be used to predict end of semester examination scores from the CAT scores. [8 Marks]
- Find the estimated semester examination scores for the midterm score of 50, comment on your result. [3 Marks]

QUESTION SEVEN [13 Marks]

- Give four properties of chi-square distribution [3 Marks]
- Calculate the coefficient of Skewness α_3 and the coefficient of kurtosis α_4 for the data 5, 6, 7, 6, 9, 4, 5 [5 Marks]
- Researchers were interested in studying the social interaction of different adults. They sought to determine if social interaction can be tied to self-confidence. The researchers classified 17 participants into three groups; high, medium and low based on their social interaction. Data was analyzed and gave the following output.

Ranks

group	N	Mean Rank
score High	6	13.92
Medium	5	8.10
Low	6	4.83
Total	17	

Test Statistics^{a,b}

	score
Chi-Square	9.944
df	2
Asymp. Sig.	.007

a. Kruskal Wallis Test

b. Grouping Variable:
group

Give an interpretation of the above output.

[5 Marks]

TABLE A22 (Continued) (0.95 Quantiles)

k_1 k_2	1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24

Table 3 Critical values of U (5% significance).

$n_1 \backslash n_2$	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1																					
2								0	0	0	0	1	1	1	1	1	1	2	2	2	2
3					0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	7	8
4				0	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	13	13
5			0	1	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20	20
6			1	2	3	5	6	8	10	11	13	14	16	17	19	21	22	24	25	27	27
7			1	3	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	34
8		0	2	4	6	8	10	13	15	17	19	22	24	26	29	31	34	36	38	41	41
9		0	2	4	7	10	12	15	17	20	23	26	28	31	34	37	39	42	45	48	48
10		0	3	5	8	11	14	17	20	23	26	29	33	36	39	42	45	48	52	55	55
11		0	3	6	9	13	16	19	23	26	30	33	37	40	44	47	51	55	58	62	62
12		1	4	7	11	14	18	22	26	29	33	37	41	45	49	53	57	61	65	69	69
13		1	4	8	12	16	20	24	28	33	37	41	45	50	54	59	63	67	72	76	76
14		1	5	9	13	17	22	26	31	36	40	45	50	55	59	64	67	74	78	83	83
15		1	5	10	14	19	24	29	34	39	44	49	54	59	64	70	75	80	85	90	90