Program: MScTE (3rd Semester), PhD (1st Semester)
Semester: Winter

Date: 9 October 2023, Afternoon
Time: 2.30 pm to 4.00 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF TECHNICAL AND VOCATIONAL EDUCATION (TVE)

Examination: Mid Semester
Course No: TVE 6355
Course Title: Quantitative Research and Advanced Statistics

Academic Year: 2022-2023
Full Marks: 75
Time: 90 minutes

There are 4 (four) questions. Answer three (3) questions.
Figures in the right margin indicate marks of the questions.

1.	(a) Research is a process in which a researcher engages in a small set of logical steps. Discuss the three key steps that a researcher must engage during the research process.	(12)	CO1
	(b) *Just because a problem exists, and a researcher can clearly identify the issue does not mean that the researcher can or should investigate it.* - Justify the statement with example.	(13)	CO1
2.	(a) Classify the types of quantitative research questions.	(5)	CO1
	(b) *A researcher wants to examine the relationship of critical thinking skills to student achievement in engineering program for first year students in a public university. The researcher moderates the assessment of critical thinking using prior grades as indicators and controls parents' educational attainment.* - Based on this study, write down one research question for each of the classifications you have mentioned in **question 2 (a)**.	(10)	CO1
	(c) *A researcher wants to investigate the performance of emotionally at-risk and non-at-risk first year students at IUT on math test scores.* i) State a directional hypothesis and the corresponding null hypothesis with equation. ii) State a non-directional hypothesis and the corresponding null hypothesis with equation.	(10)	CO1
3.	(a) Differentiate between parametric and non-parametric tests.	(5)	CO2
	(b) Define confidence level, confidence interval, Level of significance and p- value. Interpret the following two outcomes- i) The p-value is greater than alpha. ii) The p-value is less than or equal to alpha.	(6)	CO3
	(c) Explain type-I and type-II errors. How can a researcher minimize the chance of committing a type-I or type-II error while declaring the confidence level of his study?	(6)	CO2 CO3
	(d) *A researcher is experimenting with a new teaching method to teach differential calculus to first-year engineering students. The research hypothesis (H_a) is that the new method of teaching results in higher learning achievement than the traditional method. What would be the possible interpretation and consequences if the researcher committed the following error in his conclusion?* i) Type- I error. ii) Type- II error.	(8)	CO2 CO3
4.	(a) The expression $p < .001$ occurs in the results section of a journal article. Does this indicate that the investigator used a very strict level of significance to test the null hypothesis? Explain.	(5)	CO2 CO3
	(b) For each of the following instances, locate the regions of rejection and the sample results on a rough distribution sketch; perform the test; and give final conclusions about the value of μ. i) H_0: $\mu = 50$, H_1: $\mu \neq 50$, $\alpha = 0.05$, sample: 49, 48, 54, 44, 46 ii) H_0: $\mu = 20$, H_1: $\mu < 20$, $\alpha = 0.01$, sample: 11, 19, 17, 15, 13, 22, 12, 22, 10, 17	(12)	CO2 CO3
	(c) What are the assumptions that a researcher needs to satisfy before conducting a one sampled *t-test*?	(8)	CO2 CO3

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Formulae: TVE 6355

[The symbols have their usual meanings]

$$t = \frac{\bar{X} - \mu}{s_{\bar{X}}} \qquad s_{\bar{X}} = \frac{s}{\sqrt{N}} \qquad s = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N - 1}}$$

Critical Values for the *t*-Distribution

	Level of Significance for One-Tailed Test					
	.10	.05	.025	.01	.005	.0005
	Level of Significance for Two-Tailed Test					
df	.20	.10	.05	.02	.01	.001
1	3.078	6.314	12.706	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	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
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