



<b>QUALIFICATION : BACHELOR OF SCIENCE HONOURS IN APPLIED STATISTICS</b>	
<b>QUALIFICATION CODE: 08BSSH</b>	<b>LEVEL: 8</b>
<b>COURSE: SAMPLING THEORY</b>	<b>COURSE CODE: SAT802S</b>
<b>DATE: NOVEMBER 2023</b>	<b>SESSION: 1</b>
<b>DURATION: 3 HOURS</b>	<b>MARKS: 100</b>

**FIRST OPPORTUNITY: QUESTION PAPER**

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**MODERATOR:** Dr Isak Neema

**INSTRUCTIONS:**

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

**PERMISSIBLE MATERIALS:**

1. Non-Programmable Calculator

**ATTACHEMENTS**

1. T table

**This paper consists of 4 pages including this front page**

**QUESTION 1 [25]**

- a) Discuss the following concepts as used in sampling theory
  - (i) Sampling design [2]
  - (ii) Quota Sampling [2]
  - (iii) Non-probability sampling [2]
  - (iv) Snow ball [2]
  - (v) Sampling error [2]
- b) Write a short notes on the concepts: Sampling error and Non-sampling error [4]
- c) Discuss why we use the sampling with replacement in sampling theory? [5]
- d) Briefly discuss three principal reasons for using stratified random sampling rather than simple random sampling [6]

**Question 2[25]**

2.1 To estimate the total number of students needed to work on a turn-around strategy, the Registrar office subdivide the strategy into 100 equally sized units. The observed samples are given below;

234, 256, 128, 245, 211, 240, 202, 267

- a) Estimate the population total [4]
  - b) Estimate  $Var(\bar{y})$  [6]
- 2.2 A farm has 1000 young pigs with a weight of about 50 lbs (1 pound=0.45kg). They put them on a new diet for 3 weeks (minimum weight is estimated to be 10lbs).
- a) How many pigs should they sample to estimate the average weight gain, if they want the answer to be within 2 lbs. with 90% confidence. [15]

**Question 3[50]**

3.1 NUST knows that 40% of its account receivable comes from student and 60% from Government (subsidy). An auditor randomly sampled 100 accounts without replacement. Here are the results of his sampling:

Students	Government
$n_1=70$	$n_2=30$
$\bar{y}_1=520$	$\bar{y}_2=280$
$s_1=210$	$s_2=90$

- a) Compute the post-stratified mean and the variance of the post-stratified [10]

- b) The auditor wants to estimate the proportion of each stratum that pays towards NUST, if  $N_1 = 50, N_2 = 60, N_3 = 35$ , use the table below to answer the following questions

Stratum	Sample size	sample proportion
Students	20	0.8
Government	8	0.5
Others	12	0.5

- (i) Compute the estimator for the population proportion [4]  
(ii) Compute the variance for each stratum [9]

- 3.2 A mathematics achievement test was given to 486 students prior to entering a certain college who then took a calculus class. A simple random sampling of 10 students are selected and their calculus score recorded. It is known that the average achievement test score for the 486 students was 52. Study the following output and ANOVA table and answer the questions that follows.

Output			
Predictor	Coef	StDev	
Cons	40.784	8.507	
X	0.7656	0.175	
ANOVA			
Source	DF	SS	MS
Regression	1	1450	1450
Residual	8	606	75.8

- a) Using the results from the output, what do you get for the regression estimate? [4]  
b) What is the variance of the regression estimate? [8]  
c) Calculate the 95% CI for  $\mu$  [8]  
d) Find  $R^2$  [3]  
e) Compute the t-values for each predictor [2]  
f) Compute the F statistics [2]

END

### 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
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659