THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF BASIC SCIENCES
ACADEMIC YEAR 2018/2019 – SEMESETER II

BACHELOR OF PHARMACY HONOURS – LEVEL 5
BACHELOR OF MEDICAL LABORATORY SCIENCES HONOURS – LEVEL 5
BSU5230 – APPLIED STATISTICS
CONTINUOUS ASSESSMENT I (NBT I)

DATE: 15.07.2019

DURATION: ONE HOUR
TIME:9.00 AM – 10.00 AM

REGISTRATION NO: ....

This question paper consists of 10 pages with 10 Multiple Choice Questions (Part A), 10 True/False statements (Part A) and 02 Structured Essay Questions (Part B).

IMPORTANT INSTRUCTIONS TO CANDIDATES

- Write your Registration Number in the space provided.

- Answer **ALL questions.**

- **Multiple Choice Questions (Part A):** Indicate answers in the answer sheet provided by placing a cross (X) in INK in the relevant cage. (answers in pencil will **NOT** be marked)

- **True / False Questions (Part A):** Indicate answers in the answer sheet provided by placing a cross (X) in INK in the relevant cage. (answers in pencil will **NOT** be marked)

- **Structured Essay Questions (Part B):** Write answers within the space provided. Use an INK pen to answer. (answers in pencil will **NOT** be marked)

- Do not remove any page/part of this question paper and do not take the paper out of the examination hall.

- Mobile phones and any other electronic equipment are **NOT** allowed. Leave them outside.

- Scientific Calculators are allowed.

- Please fill the address sheet. (See last page)

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Part A – Multiple Choice Questions and True/False Statements

*(10 * 2 = 20 marks)*

1. Choose the most suitable answer and indicate with a 'X' in the answer sheet

ANSWER SHEET FOR PART A : Question 01

Q. 1	(a)	(b)	(c)	(d)
1.1				
1.2				
1.3				
1.4				
1.5				
1.6				
1.7				
1.8				
1.9				
1.10				

ANSWER SHEET FOR PART A : Question 02

Q. 2	True	False
2.1		
2.2		
2.3		
2.4		
2.5		
2.6		
2.7		
2.8		
2.9		
2.10		

REGISTRATION NO: ....

Part A – Multiple Choice Questions and True/False Statements

(1 * 20 = 20 marks)

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1. **Multiple Choice Questions: Choose the most suitable answer and indicate with a 'X' in the answer sheet**

   1.1 A researcher has found out that in a random sample of 19 football players, the average pulse rate is x = 76 beats per minute. What is the appropriate critical table he should use when building confidence interval levels for the sampling mean?

   (a) Z-table

   (b) t-table

   (c) Chi-square table

   (d) F-table

   1.2 For a parameter whose value is unknown, belief or claim for that parameter is classified as

   (a) parameter claim testing

   (b) expected belief testing

   (c) hypothesis testing

   (d) primary limit testing

   1.3 In hypothesis testing, a Type 2 error occurs when,

   (a) The null hypothesis is not rejected when the null hypothesis is true.
   (b) The null hypothesis is rejected when the null hypothesis is true.
   (c) The null hypothesis is not rejected when the null hypothesis is false.
   (d) The null hypothesis is rejected when the alternative hypothesis is true.

   1.4 Null and alternative hypotheses are statements about:

   (a) population parameters.

   (b) sample parameters.

   (c) sample statistics.

   (d) May be. sometimes population parameters and sometimes sample statistics.

1.5 A is hypothesis conducted at 95% significance level to check whether there is a significant difference between IQ scores of math-stream students and language-stream students. The p-value for the test is calculated to be 0.25. Which statement is most accurate?

(a) We can conclude that more than 25% of the population perform significantly differently.

(b) We can conclude that more than 5% of the population perform significantly differently.

(c) There is not enough evidence to say that there is a significant difference between IQ scores of math-stream students and language-stream students at 95% confidence level.

(d) We cannot say anything

1.6 Which of the following is/are the main types of inferential statistics?

i. Confidence Interval estimation
ii. Hypothesis testing
iii. Graphical representation of sample data
iv. Summarization of sample data

(a) (i) , (ii) and (iv)

(b) (iii) and (iv)

(c) (i) and (ii)

(d) All of the above

1.7 A result is called "statistically significant" whenever

(a) The null hypothesis is true.

(b) The alternative hypothesis is not true.

(c) The p-value is less or equal to the significance level.

(d) The p-value is larger than the significance level.

1.8 Which of the following is not a correct way to state a null hypothesis?

(a) $H_0: \hat{p}_1 - \hat{p}_2 = 0$

(b) $H_0: \mu_d = 10$

(c) $H_0: \mu_1 - \mu_2 = 0$

(d) $H_0: P = 0.5$

1.9 A randomly selected sample of 1,000 college students was asked whether they had ever smoked. Sixteen percent (16% or 0.16) of the 1,000 students surveyed said they had. Which one of the following statements about the number 0.16 is correct?

(a) It is a sample proportion.

(b) It is a population proportion.

(c) It is a margin of error.

(d) It is a randomly chosen number

1.10 Range or set of values which have chances to contain value of population parameter with a specific confidence level is considered as

(a) secondary interval estimation

(b) confidence interval estimate

(c) population interval estimate

(d) sample interval estimate

2. True/False statement Questions: Choose the correct answer and indicate with a 'X' in the answer sheet

2.1 Shape of the t-distribution is determined by the number of degrees of freedom and the distribution approaches to a normal distribution as sample size grows (TRUE/ FALSE)

2.2 It is possible to construct a 100% confidence interval estimate for the population mean using sample statistics. (TRUE/ FALSE)

2.3 In practice, the population mean is an unknown quantity that is to be estimated. (TRUE/ FALSE)

2.4 The confidence intervals start getting narrower as sample size increases (TRUE/ FALSE)

2.5 Value of $\alpha = 0.02$ (α is the significance level) when confidence level is 98% (TRUE/ FALSE)

2.6 For a single sample t-test, degrees of freedom for a sample size of 18, is 15. (TRUE/ FALSE)

2.7 Point estimate is defined as a sample statistic which is used to estimate a population parameter (TRUE/ FALSE)

2.8 When the null hypothesis is found to be true, the alternative hypothesis must also be true. (TRUE/ FALSE)

2.9 Level of significance is also known as size of the rejection region or size of the critical region. (TRUE/ FALSE)

2.10 A type I error is committed by rejecting a null hypothesis when it is true. (TRUE/ FALSE)

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Part B –Structured Essay Questions
(80 marks)

Write answers in the space provided.

3. In a study to analyze the SAT scores between local-school students and international-school students, following data were collected.

Local	230	256	321	249	275	285	299	305	265	255	244
	310	320	310	311	302	296	298	246	289	299	291
	287	290	306	310	332	310	298	299	278	299	
International	215	219	233	265	294	254	300	271	242	262	244
	265	255	247	290	268	300	256	265	255	247	274
	280	248	257	275	246	264	299	309	300	265	

i)   Calculate the mean for Local school students **(04 marks)**

ii) Calculate the mean for International school students **(04 marks)**

iii) Suppose the sample standard deviations of the two data sets are as follows;

Data set	Sample Standard Deviation (sample S.D)
Local	25.09
International	23.46

a. What is the standard error for 'Local-school' data set **(04 marks)**

b. What is the standard error for 'International-school' data set **(04 marks)**

iv) What is the statistical table we may use to develop confidence interval levels for the given question? Give reasons. *Hint: sample size > 30* **(05 marks)**

v) What is the 95% critical value for the statistical table you have chosen above. **(05 marks)**

vi) a. What is the Margin of Error for 'Local-school' data set **(04 marks)**

b. What is the Margin of Error for 'International-school' data set **(04 marks)**

vii) Give 95% Confidence Interval Levels for 'Local-school' data set **(04 marks)**

viii) Give 95% Confidence Interval Levels for 'International-school' data set **(04 marks)**

ix)   Compare the confidence intervals and interpret the results. (04 marks)

x)   Had the sample size been 25, would you have picked a different statistical table for your calculation? Justify your answer. (04 marks)

04. A researcher wishes to test the claim 'average uric acid levels between individuals with Down's syndrome and normal individuals are different'. He randomly selects two samples, one sample from Down's syndrome people and one sample from normal people. Following data refers to above scenario.

Sample data	Down's syndrome sample	Normal sample
Sample Mean	4.5	3.4
Sample S.D	1.000	1.2247
Sample size	12	15

i.   Clearly state the null hypothesis and alternative hypothesis. (05 marks)
Let ,
μ_D = average uric acid levels of Down's Syndrome people and
μ_N = average uric acid levels of normal people
be population parameters (H_0 and H_a)

ii. What is the statistical table the researcher may use? Give reasons. (03 marks)

iii. Calculate the test statistic using the equation below **(10 marks)**

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)_0}{\sqrt{s_p^2 / n_1 + s_p^2 / n_2}}$$

iv. What is the value of 'degrees of freedom' for this test? **(02 marks)**

v. Find the table value for 95% confidence level. (0.05 significance level) **(05 marks)**

vi. Compare the calculated value and the statistical table value, and interpret the results **(05 marks)**
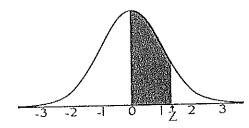
t table: Two tailed

DF	0.20	0.10	0.05	0.02	0.01	0.005	0.002	0.001
1	3.078	6.314	12.706	31.820	63.657	127.321	318.309	636.619
2	1.886	2.920	4.303	6.965	9.925	14.089	22.327	31.599
3	1.638	2.353	3.182	4.541	5.841	7.453	10.215	12.924
4	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	1.397	1.860	2.306	2.897	3.355	3.833	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	1.345	1.761	2.145	2.625	2.977	3.326	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	1.337	1.746	2.120	2.584	2.921	3.252	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819

23	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.768
24	1.318	1.711	2.064	2.492	2.797	3.090	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
31	1.309	1.695	2.040	2.453	2.744	3.022	3.375	3.633
32	1.309	1.694	2.037	2.449	2.738	3.015	3.365	3.622
33	1.308	1.692	2.035	2.445	2.733	3.008	3.356	3.611
34	1.307	1.691	2.032	2.441	2.728	3.002	3.348	3.601
35	1.306	1.690	2.030	2.438	2.724	2.996	3.340	3.591
40	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
50	1.299	1.676	2.009	2.403	2.678	2.937	3.261	3.496
100	1.290	1.660	1.984	2.364	2.626	2.871	3.174	3.391
500	1.283	1.648	1.965	2.334	2.586	2.820	3.107	3.310
∞	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291

Z Table

STANDARD NORMAL TABLE (Z)

Entries in the table give the area under the curve between the mean and z standard deviations above the mean. For example, for $z = 1.25$ the area under the curve between the mean (0) and z is 0.3944.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0190	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2969	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3513	0.3554	0.3577	0.3529	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998