CONFIDENTIAL

UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BGE 2123
COURSE	: STATISTICS
SEMESTER/SESSION	: 1-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **11** questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 13 PRINTED PAGES INCLUDING COVER PAGE

SECTION A (50 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

The TNB branch Kuantan is conducting a survey to find out the average monthly consumption of electricity in a housing area. The area consists of 10 blocks a double-storey house. Each block consists of 10 houses. A random sample of 5 blocks is selected. All the houses in each block are included as units in the sample.

a) Determine the population and sample in this survey. (2 marks)

b) What is the variable of interest? Is it a qualitative or a quantitative variable? (2 marks)

c) Suggest an appropriate sampling technique used in this survey. (2 marks)

QUESTION 2

Based on data from Amazing Today, the ages of a random sample of 300 adults who shop by catalog are:

Age	15-24	25-34	35-44	45-54	55-64	65-74
Number	75	78	48	36	33	30

a) Calculate the mean for the above distribution. (3 marks)

b) Calculate the mode for the above distribution. (4 marks)

QUESTION 3

In a photographic process, the developing time of prints may be looked upon as a random variable having the normal distribution with $\mu = 15.40$ seconds and $\sigma = 0.48$ second. Find the probabilities that the time it takes to develop one of the prints will be:

a) At least 16 seconds. (3 marks)

b) At most 14.20 seconds. (3 marks)

c) Anywhere from 15 to 15.80 seconds. (4 marks)

QUESTION 4

In a survey involving 100 cars, each vehicle was classified according to whether or not it had antilock brakes and whether or not it had been involved in an accident in the past year. Suppose that one of these cars is randomly selected for inspection.

	Antilock Brakes (B)	No Antilock Brakes (B')
Accident (A)	3	12
No Accident (A')	40	45

Compute:

a) $P(A)$ (2 marks)

b) $P(B)$ (2 marks)

c) $P(B' \cap A')$ (2 marks)

d) $P(B \mid A')$ (2 marks)

e) Are the events antilock brakes and accident independent? Explain? (2 marks)

QUESTION 5

The discrete random variable R has a probability distribution function given by $f(r) = kr^2$ for $r = 1,2,3,4$. Find:

a) The value of k. (2 marks)

b) $P(R \geq 2)$ (3 marks)

c) $E(R)$ (3 marks)

d) $Var(R)$ (3 marks)

QUESTION 6

A recent survey by the Accounting Association revealed 23% of students graduating with a major in accounting select public accounting. Suppose we select a sample of 15 recent graduates. Using binomial model, find:

a) The probability no students select public accounting? (2 marks)

b) The probability two students select public accounting. (2 marks)

c) The expected number of students select public accounting. (2 marks)

SECTION B (30 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

When pond water is examined under the microscope there are nasty bugs to be seen. The average concentration of these bugs is 5 per milliliter. Determine the probability that a random sample of 4 milliliters of pond water contains exactly 15 bugs:

a) Using the Poisson distribution. (2 marks)

b) Using the Normal approximate to the Poisson distribution. (5 marks)

QUESTION 2

A survey of purchasing agents from 300 industrial companies found that 30% of the buyers reported higher levels of new orders in January than in earlier months. Assumes that the 300 purchasing agents in the sample represent a random sample of company purchasing agents throughout Terengganu.

a) Find $\mu_{\bar{p}}$ and $\sigma_{\bar{p}}$. (3 marks)

b) Develop a 90% confidence interval for the proportion of purchasing agent from industrial company (5 marks)

QUESTION 3

Various doses of a poisonous substance were given to group of mice and the following results were observed:

Dose (mg) x	Number of deaths y
4	1
6	3
8	6
10	8
12	14
14	16
16	20

a) Find the Pearson's correlation between dose and number of deaths in group of mice. Explain the value. (6 marks)

b) Find the equation of the least squares line fit to these data. (6 marks)

c) Estimate the number of deaths in group of mice who receive a 7-miligram dose of this poison. (3 marks)

SECTION C (20 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

A mail-order house employs three stock clerks, U, V and W, who pull items from shelves and assemble them for subsequent verification and packaging. U makes a mistake in an order (gets a wrong item or the wrong quantity) one time in hundred, V makes a mistake in an order five times in a hundred, and W makes a mistake in an order three times in a hundred. If U, V and W fill, respectively, 30, 40 and 30 percent of all orders, what are the probabilities that:

a) A mistake will be made in an order. (2 marks)

b) If a mistake is made in an order, the order was filled by U. (3 marks)

QUESTION 2

ATMs must be stocked with enough cash to satisfy customers making withdrawals over an entire weekend. But if too much cash is unnecessarily kept in the ATMs, the bank is forgoing the opportunity of investing the money and earning interest. Suppose that at a particular branch the population mean amount of money withdrawn from ATMs per customer transaction over the weekend is RM160 with a population standard deviation of RM30.

a) If a random sample of 36 customer transaction indicates that the sample mean withdrawal amount is RM172, is there evidence to believe that the population mean withdrawal amount is no longer RM160. (Use a 0.05 level of significance). Use 5 step of hypothesis testing. (10 marks)

b) Develop a 99% confidence interval for the mean withdrawal amount. (5 marks)

--End of question--------------------------------------

FORMULA

Relative frequency $= \dfrac{f}{\sum f}$	Midpoint, $x = \dfrac{\text{Lower limit} + \text{Upper limit}}{2}$
$\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$	$\bar{x} = \dfrac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}$
$Median, \tilde{x} = L_m + \left(\dfrac{\dfrac{\sum f}{2} - \sum f_{m-1}}{f_m} \right) \times C_m$ L_m = Lower bound of median class f_m = Frequency of median class $\sum f_{m-1}$ = Cumulative frequency before median class C_m = Size of median class $\sum f$ = Number of observation /total frequency	$s^2 = \dfrac{1}{\sum f - 1}\left(\sum f_i x_i^2 - \dfrac{\left(\sum f_i x_i\right)^2}{\sum f} \right)$ $s = \sqrt{s^2}$
$Mode = L_{mo} + \left(\dfrac{d_1}{d_1 + d_2} \right) \cdot C_{mo}$ L_{mo} = Lower bound of mode class C_{mo} = Size of mode class d_1 = Difference between modal class frequency and the previous class frequency d_2 = Difference between modal class frequency and the next class frequency	

Probability

1. $P(A\mid B)=\dfrac{P(A\cap B)}{P(B)}$

2. a) $P(A\cap B)=P(B)\cdot P(A\mid B)$

   b) $P(A\cap B)=P(A)\cdot P(B)$ if and only if A and B are independent events.

3. $P(A\mid B)=\dfrac{P(A)\cdot P(B\mid A)}{P(A)\cdot P(B\mid A)+P(A')\cdot P(B\mid A')}$

4. a) $P(X=x)=\binom{n}{x}p^x q^{n-x}\quad x=0,1,..,n$ *b)* $P(X=x)=\dfrac{\lambda^x e^{-\lambda}}{x!}\quad x=0,1,..$

5. a) $Z=\dfrac{X-np}{\sqrt{npq}}$ *b)* $Z=\dfrac{X-\lambda}{\sqrt{\lambda}}$

6. $E(X)=\sum_{-\infty}^{\infty}x\cdot f(x)=\int_{-\infty}^{\infty}x\cdot f(x)\,dx$

7. $E(X^2)=\sum_{-\infty}^{\infty}x^2\cdot f(x)=\int_{-\infty}^{\infty}x^2\cdot f(x)\,dx$

8. $Var(X)=E(X^2)-\left[E(X)\right]^2$

Regression and Correlation

1. $r=\dfrac{(\Sigma XY)-\dfrac{(\Sigma X)(\Sigma Y)}{n}}{\sqrt{\left[(\Sigma X^2)-\dfrac{(\Sigma X)^2}{n}\right]\left[(\Sigma Y^2)-\dfrac{(\Sigma Y)^2}{n}\right]}}$

2. $b=\dfrac{(\Sigma XY)-\left(\dfrac{(\Sigma X)(\Sigma Y)}{n}\right)}{\left((\Sigma X^2)-\dfrac{(\Sigma X)^2}{n}\right)}$

3. $a=\dfrac{(\Sigma y)}{n}-b\dfrac{(\Sigma x)}{n}$

Confidence Interval and Hypothesis Testing

Estimator	Confidence Interval	Test Statistics
$\mu_1 - \mu_2$	$(\bar{x}_1 - \bar{x}_2) - z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$	$Z_0 = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$
	$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ $v = n_1 + n_2 - 2$	$T_0 = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$
	$(\bar{x}_1 - \bar{x}_2) - z_{\alpha/2} s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + z_{\alpha/2} s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ $s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$	$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$
	$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2,v} s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2,v} s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ $v = n_1 + n_2 - 2$ $s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$	$T_0 = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$

Confidence Interval and Hypothesis Testing

Estimator	Confidence Interval	Test Statistics
μ	$(\bar{x}) - z_{\alpha/2}\frac{s}{\sqrt{n}} < \mu < (\bar{x}) + z_{\alpha/2}\frac{s}{\sqrt{n}}$	$Z_o = \frac{\bar{X}-\mu_o}{s/\sqrt{n}} \sim N(0,1)$
	$(\bar{x}) - t_{\alpha/2,n-1}\frac{s}{\sqrt{n}} < \mu < (\bar{x}) + t_{\alpha/2,n-1}\frac{s}{\sqrt{n}}$	$T_o = \frac{\bar{X}-\mu_o}{s/\sqrt{n}} \sim t_{n-1}$

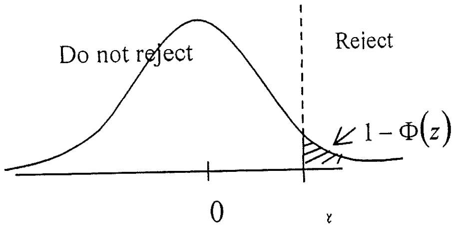
Estimator	Confidence Interval	Sample size
$\hat{p}$	$\hat{p} - z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} < p < \hat{p} + z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	$n = \frac{z_{\alpha/2}^2 \cdot \hat{p}(1-\hat{p})}{E^2}$

APPENDIX I

Table I Standard Normal Distribution

$$1-\Phi(z)=P(Z>z)=\frac{1}{\sqrt{2\pi}}\int_{z}^{\infty}e^{-z^2/2}dz$$

$$z=\frac{x-\mu}{\sigma}$$



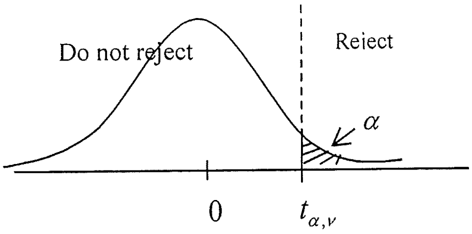
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
3.7	.000108	.000104	.000100	.000096	.000092	.000088	.000085	.000082	.000078	.000075
3.8	.000072	.000069	.000067	.000064	.000062	.000059	.000057	.000054	.000052	.000050
3.9	.000048	.000046	.000044	.000042	.000041	.000039	.000037	.000036	.000034	.000033
4.0	.000032									

5.0 → 0.0000002867   5.5 → 0.0000000190   6.0 → 0.0000000010

APPENDIX II

Table II Student's t Distribution

The table gives the value of $t_{\alpha,\nu}$ - the $100\,\alpha$ percentage point of the t distribution for degrees of freedom.



ν \ α	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
1	3.078	6.314	12.706	31.821	63.657	318.31	636.62
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291