Borang ini berwarna kuning

USM/PTJNC/BPA-PEP/PK01/L03

LAMPIRAN D4

Untuk kegunaan pejabat Unit Peperiksaan & Pengijazahan		
Nombor Sampul		
Tarikh & Sesi Peperiksaan		

PENYEMAKAN KERTAS SOALAN PEPERIKSAAN
(Proof-reading of Examination Question Paper)

Gunakan satu proforma untuk satu kertas soalan peperiksaan.
(Use separate form for each question paper)

Sila tandakan (X) jika kertas soalan peperiksaan ini kategori 'TERTUTUP' [ ]

Kepada : Ketua Penolong Pendaftar
Unit Peperiksaan & Pengijazahan, BPA, Jabatan Pendaftar

SAYA/KAMI TELAH MENYEMAK SALINAN-SALINAN KERTAS SOALAN PEPERIKSAAN BERTAIP YANG DISEBUTKAN DI BAWAH INI:

[I/We have checked the typed copies of the Examination Paper stated below:]

Kod Kursus : EEE382 *(Course Code)*

Tajuk Kursus : KEBARANGKALIAN DAN STATISTIK KEJURUTERAAN *(Course Title)*

Jangka Masa Peperiksaan : *(Duration of Examination)* 3 Jam *(Hours)*

Bilangan Muka Surat Bertaip : *(Number of Typed: Pages)* 12 Muka Surat *(Pages)*

Bilangan Soalan Yang Perlu Dijawab : *(Number of questions required to be answered)* 4 Soalan *(Questions)*

Tarikh Penilaian Kertas Soalan Ini: *(Date Of Vetting For This Question Paper)* 23/11/22

Soalan-soalan dijawab atas : *(Questions to be answered in)* Sila (√) *[Please (√)]*	**BUKU JAWAPAN** *(Answer Book)*	**BORANG OMR** *(OMR Form)*	**JAWAB ATAS KERTAS SOALAN** *(Answer on Question Paper)*
	✓		

DENGAN INI DISAHKAN BAHAWA KERTAS SOALAN PEPERIKSAAN INI TELAH MELALUI PROSES PENILAIAN TERATUR, BETUL, DAN SEDIA UNTUK DICETAK.
(Certified that this question paper has been vetted, is in order, correct and ready for printing)

Nama Pemeriksa : *[Name of Examiner(s)]* • Huruf Besar *(In Block Capitals)*	**Tandatangan :** *(Signature)*	**Tarikh :** *(Date)*
Dr. AEIZAAL	[signature]	2/12/22
AZMAN ABDULWAHAB		
DR ZURAIMI DAHARI	[signature]	7/12/22
Dr. TEH JIASHEN	[signature]	7/12/22

Tandatangan dan Cop Rasmi : DEKAN/PENGARAH *(Signature and Offical Stamp Dean/Director)* [signature]

PROFESOR Ir. Ts. Dr. SHAHREL AZMIN BIN SUNDI@SUANDI
Dekan
Pusat Pengajian Kejuruteraan Elektrik dan Elektronik
Kampus Kejuruteraan
Universiti Sains Malaysia

Tarikh : *(Date)* 21.12.2022

NOTA : **Pemeriksa-pemeriksa yang menyediakan kertas soalan peperiksaan adalah bertanggungjawab atas ketepatan isi kandungan kertas soalan peperiksaan berkenaan.**

(NOTE : Accuracy of the contents of the question paper is the responsibility of the Examiner(s) who set the question paper)

First Semester Examination
2022/2023 Academic Session

February 2023

EEE382 – Probability And Engineering Statistics
(Kebarangkalian Dan Statistik Kejuruteraan)

Duration : 3 hours
(Masa : 3 jam)

Please check that this examination paper consists of **TWELVE (12)** pages of printed material including appendix before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **DUA BELAS (12)** muka surat yang bercetak termasuk lampiran sebelum anda memulakan peperiksaan ini.]*

Instructions : This paper consists of **FOUR (4)** questions. Answer **ALL** questions.

*[**Arahan** : Kertas ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan.]*

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

1. (a) A fastfood restaurant's manager has estimated that on average, 100 people per hour stop by his restaurant.

Seorang pengurus restoran makanan segera menganggarkan secara purata, 100 orang akan singgah di restorannya.

(i) Find the probability that in a given 3 minutes period, nobody enters the restaurant.

Cari kebarangkalian bahawa dalam tempoh 3 minit, tiada Pelanggan memasuki restoran tersebut.

(15 marks/*markah*)

(ii) Find the probability that in given 3 minutes period, more than 5 people enter the restaurant.

Cari kebarangkalian bahawa dalam tempoh 3 minit, lebih daripada 5 pelanggan memasuki restoran tersebut.

(15 marks/*markah*)

(b) The distribution of heights of a certain type of lemon tree has a mean height of 72 cm and a standard deviation of 10 cm, whereas the distribution of heights of a guava tree has a mean height of 28 cm and a standard deviation of 5 cm. Assuming that the sample means can be measured to any degree of accuracy, find the probability that the sample means for a random sample of heights of 64 lemon tree exceeds the sample mean for a random sample of heights of 100 guava tree at most 44.2 cm.

Taburan ketinggian bagi pokok lemon tertentu mempunyai purata ketinggian 72 cm dan sisihan piawai 10 cm, manakala taburan ketinggian pokok jambu batu mempunyai ketinggian 28 cm dan sisihan piawai 5 cm. Dengan anggapan bahawa purata sampel boleh diukur pada sebarang ketepatan, cari kebarangkalian bahawa purata sampel ketinggian bagi sampel rawak 64 pokok lemon melebihi purata sampel ketinggian bagi sampel rawak 100 pokok jambu batu semaksimum mungkin pada 44.2 cm.

(30 marks/*markah*)

(c) A box of manufactured capacitors whose capacitance values are normally distributed with mean 10 μF and standard deviation of 1 μF.

Sebuah kotak kapasitor yang dihasilkan mempunyai nilai kapasitan dengan taburan normal dengan purata 10 μF dan sisihan piawai 1 μF.

(i) What is the probability that the capacitors have capacitance between 9.3 and 10.7 μF?

Apakah kebarangkalian bahawa kapasitor mempunyai kapasitan antara 9.3 dan 10.7 μF?

(15 marks/*markah*)

(ii) If 100 capacitors is sampled, what is the probability that 50 or more than them will have capacitance between 9.3 and 10.7 μF?

Sekiranya 100 kapasitor disampelkan, apakah kebarangkalian bahawa 50 atau lebih akan mempunyai kapasitan antara 9.3 dan 10.7 μF?

(25 marks/*markah*)

2. (a) Define the null hypothesis, H_0 and the alternative hypothesis, H_1

Takrifkan hipotesis sifar, H_0 dan hipotesis alternative, H_1 berikut:

(i) A claim is made that the average time to make a name-brand ready-mix pie is five minutes.

Satu tuntutan dibuat bahawa purata masa untuk membuat pai adalah lima minit.

(ii) Another company claims that its pie takes less than six minutes to make.

Syarikat yang lain membuat tuntutan bahawa pai mereka mengambil masa kurang dari enam minit untuk dihasilkan.

(10 marks/*markah*)

(b) Given a data set of 106 healthy body temperatures, where the mean was 98.2°C and s = 0.62°C, at the 0.05 significance level, test the claim that the mean body temperature of all healthy adults is equal to 98.6°C.

Set data diberi untuk 106 suhu badan yang sihat, di mana puratanya adalah 98.2°C *dan s* = 0.62°C, *pada aras siknifikan 0.05, uji tuntutan bahawa purata suhu badan untuk orang dewasa yang sihat adalah* 98.6°C.

(10marks/*markah*)

(c) From Question 2(b), test the claim when the data set is changed to 25.

Dari soalan 2(b), uji tuntutan apabila set data ditukar kepada 25.

(10 marks/*markah*)

(a) The Acme Company has developed a new battery. The engineer in charge claims that the new battery will operate continuously for at least 7 minutes longer than the old battery.To test the claim, the company selects a simple random sample of 100 new batteries and 100 old batteries. The old batteries run continuously for 190 minutes with a standard deviation of 20 minutes; the new batteries, 200 minutes with a standard deviation of 40 minutes. Test the engineer's claim that the new batteries run at least 7 minutes longer than the old. Use a 0.05 level of significance (Assume that there are no outliers in either sample).

Syarikat Acme telah membangunkan bateri jenis baru. Jurutera yang bertanggungjawab membuat tuntutan bahawa bateri jenis baru ini akan beroperasi berterusan selama sekurang-kurangnya 7 minit lebih daribateri jenis lama. Untuk menguji tuntutan ini, syarikat telah memilih 100 sampel bateri jenis baru dan 100 sampel bateri jenis lama secara rawak. Bateri jenis lama beroperasi secara berterusan selama 190 minit dengan 20 minit sisihan piawai; manakala bateri jenis baru pula beroperasi selama 200 minit dengan 40 minit sisihan piawai. Uji tuntutan jurutera bahawa bateri jenis baru beroperasi sekurang-kurangnya 7 minit lebih lama dari bateri jenis lama. Aras siknifikan adalah 0.05 (Andaikan tiada data terpencil di dalam sampel ini).

(30 marks/*markah*)

(b) Two microprocessors are compared on a sample of six benchmark codes to determine whether there is a difference in speed. The times (in seconds) used by each processor on each code are given in the following table. Can you conclude that the mean speeds of the two processors differ? Use a 0.01 level of significance. Given $t_{0.005} = 3.25$.

Dua mikropmproses dibanding berdasarkan 6 sampel kod untuk mengenalpasti perbezaan dalam kelajuannya. Masa dalam saat bagi kedua-dua mikropemproses diberi seperti berikut,

Bolehkah disimpulkan bahawa nilai min bagi kelajuan adalah berbeza bagi kedua-dua mikropemproses ? Gunakan aras siknifikan sebanyak 0.01. Diberi $t_{0.005} = 3.25$.

Table 2(e)

Jadual 2(e)

Code/Kod

	1	**2**	**3**	**4**	**5**	**6**
Processor A	27.2	18.1	27.2	19.7	24.5	22.1
Processor B	24.1	19.3	26.8	20.1	27.6	29.8

(40 marks/*markah*)

3. (a) A new postsurgical treatment, X is being compared with a standard treatment, Y. Seven subjects receive the new treatment, while seven others receive the standard treatment. The recovery times, in days, are as follows:

Satu rawatan selepas pembedahan yang baru dibandingkan dengan rawatan yang sedia ada. Tujuh pesakit menerima rawatan baru tersebut, sementara tujuh pesakit yang lain menerima rawatan sedia ada. Masa pemulihan, dalam hari, adalah seperti berikut:

Table 3(a)

Jadual 3(a)

X	12	13	15	19	20	21	27
Y	18	23	24	30	32	35	40

Using Wilcoxon Rank Sum test, can you conclude that the mean rate differs between the new and standard treatment? Use $\alpha = 0.05$.

Dengan menggunakan ujian Berpangkat Wilcoxon, bolehkah anda menyimpulkan bahawa purata adalah berbeza antara rawatan baru dan sedia ada? Gunakan $\alpha = 0.05$.

(35 marks/*markah*)

(b) Seven different locations on a tire are measured by a gauge to obtain its tire tread depth. The results, in mm, are presented in the following table.

Sebiji tayar diukur di tujuh lokasi yang berlainan untuk mendapatkan kedalaman bunga tayar tersebut. Keputusannya, di dalam mm, diberikan seperti berikut

Table 3(b)

Jadual 3(b)

Locations/*Lokasi*	**Tire tread depth/*Kedalaman Bunga Tayar***
1	3.95
2	3.23
3	3.60
4	3.48
5	3.89
6	3.75
7	3.45

Use the Wilcoxon Signed Rank test to test $H_0: \mu = 3.62$ versus $H_1: \mu \neq 3.62$. Use $\alpha = 0.05$.

Gunakan ujian Wilcoxon Signed Rank untuk menguji $H_0: \mu = 3.62$ *dan* $H_1: \mu \neq 3.62$. *Gunakan* $\alpha = 0.05$.

(35marks/*markah*)

(c) A study is run to evaluate the effectiveness of an exercise program in reducing systolic blood pressure in patients with pre-hypertension. A total of 15 patients with pre-hypertension enrol in the study (with a mean data sample of 131 mmHg) and their systolic blood pressures are measured. The data are shown in Table 3(c). Rank the data according to the Wilcoxon Signed Rank Test.

Satu kajian telah dijalankan untuk menilai keberkesanan program senaman untuk menurunkan tekanan darah di dalam pesakit darah tinggi. Sejumlah 15 pesakit dengan darah tinggi menyertai kajian ini (purata sampel adalah 131 mmHg) dan tekanan darah mereka telah diukur. Data ditunjukkan seperti Jadual 3(c). Susun data mengikut ujian Wilcoxon Signed Rank.

Table 3 (c)

Jadual 3 (c)

Patient/Pesakit	Systolic Blood Pressure/Tekanan Darah (mmHg)
1	125
2	132
3	120
4	125
5	127
6	131
7	132
8	128
9	127
10	130

(30 marks/*markah*)

4. (a) Estimate the regression line for the power data of Table 4 (a)
Anggarkan garis regresi untuk data kuasa dalam Jadual 4(a)

Table 4(a)

Jadual 4(a)

Power input, x (%)	Power output, y (%)
3	5
7	11
11	21
15	16
18	16
27	28
29	27
30	25
30	35
31	30
31	40
32	32
33	34
33	32
34	34
36	37
36	38
36	34
37	36
38	38
39	37
39	36
39	45
40	39
41	41
42	40
42	44

43	37
44	44
45	46
46	46
47	49
50	51

(40 marks/*markah*)

(b) Find a 95% confidence interval for β in the regression line $\mu_{Y|x} = \alpha + \beta x$, based on the power data of Table 4 (a)

Cari selang keyakinan 95% untuk β dalam garis regresi $\mu_{Y|x} = \alpha + \beta x$, *berdasarkan data kuasa di Jadual 4 (a)*

(20 marks/*markah*)

(c) Find a 95% confidence interval for α in the regression line $\mu_{Y|x} = \alpha + \beta x$, based on the power data of Table 4(a)

Cari selang keyakinan 95% untuk α *dalam garis regresi* $\mu_{Y|x} = \alpha + \beta x$, *berdasakan data kuasa di Jadual 4(a)*

(20 marks/*markah*)

(d) Construct a 95% prediction interval for y_0 when $x_0 = 20$
Bina selang ramalan 95% untuk y_0 apabila $x_0 = 20\%$.

(20 marks/*markah*)

-oooOooo-

APPENDIX

LAMPIRAN

Question	Course Outcome (CO)	Programme Outcome (PO)
1	CO1	PO3
2	CO2	PO3
3	CO3	PO3
4	CO2	PO3

PUSAT PENGAJIAN KEJURUTERAAN ELEKTRIK DAN ELEKTRONIK
UNIVERSITI SAINS MALAYSIA, KAMPUS KEJURUTERAAN
SEMESTER PERTAMA, SIDANG 2022/2023

MAKLUMAT KERTAS PEPERIKSAAN

A.	Kod Kertas	**EEE382**	
	Tajuk Kertas	**Kebarangkalian dan Statistik Kejuruteraan**	
	Pensyarah	**Dr. Aeizaal Azman Abdul Wahab**	**AP Dr. Zuraini Dahari**
		Ir. Ts. Dr. Teh Jiashen	
	Jumlah Salinan Asal		
	Tarikh Terima		
B.	Jurutaip		
	Tarikh Penaipan		
	Jumlah Salinan Bertaip		
C.	Tarikh Semakan		
	Salinan Lampiran Pembetulan		
	Tarikh Penaipan Pembetulan		
	Tarikh Semakan Kedua		
D.	Tarikh Vetting	PM. Dr. Dzati Athiar Ramli 23/11/2022	
	Pensyarah-pensyarah yang Terlibat	Dr. Muhammad Najwan Hamidi 23/11/2022	
	Tarikh Tandatangan Pengesahan		
	Tarikh Penyerahan ke Bahagian Peperiksaan		
	Kakitangan Terlibat		

UNIVERSITI SAINS MALAYSIA

SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING

VETTING FORM FOR COURSEWORK/EXAMINATION

Academic Session	2022/2023										
Semester	Semester 1	√	Semester 2		KSCP						
Course Name & Code	EEE 382 PROBABILITY AND ENGINEERING STATISCTICS										
Course Type	Core		√	Elective							
Credit unit	2		3	√	4		6				
Coursework and exam work percentage	40:60	√	50:50		100:0						
Type of Assessment	Examination/Test/Quiz/Assignment/Mini Project/Others: Final Examination										
Assessment Questions	Number of questions set	4									
	Number of questions to be answered	4									
Duration of Assessment	0.5 hour		1 hour		2 hours		3 hours	√	Others (specify)		
Date(s) of Assessment											
Lecturers	Course leader	Dr. Aeizaal Azman Abdul Wahab									
	Lecturer 2	Dr. Teh Jiashen									
	Lecturer 3	AP Dr. Zuraini Dahari									
Vetters	Vetter 1	AP. Dr, Dzati Athiar Ramli									
	Vetter 2	Dr. Muhammad Najwan Hamdi									

(Note: Method 1 - Each question carries 100 marks, Method 3 - Each question is awarded with an individual percentage, Method 4 - Each question is awarded with a grade)

PART A: to be completed by the lecturers of the course

(i) Description of course's Course Outcome (CO)

CO	DESCRIPTION
CO1	Able to recognize techniques to solve problems in probability, probability distribution, joint probability distribution, sampling distribution, confident interval and hypothesis testing of single and two samples
CO2	Able to recognize techniques to solve problems in simple linear regression, multiple regression, hypothesis testing in multiple regression and non parametric statistics
CO3	Able to apply the above concepts for solving engineering problems, especially for sustainable production and consumption

ii) Topics in Curriculum Planning Form (BPK)

QUESTION NUMBER	TOPICS IN CURRICULUM PLANNING FORM (BPK)
1	Joint Probability distribution
2	Hypotheses testing for one and two population
3	Wilcoxon Rank Sum Test and Wilcoxon Signed Rank Test and
4	Regression analysis

Not tally with teaching plan.
In the plan,
Q1 - CO1 - PO3 ✓
Q2 - CO1 - PO3
Q3 - CO2 + 3
Q4 - CO3 - PO6

(ii) **Mapping of each final examination question to the CO, EAC Program Outcome (PO-EAC), KPT Program Outcome (PO-KPT), Bloom Taxonomy (BT), Complex Problem Solving (CP), Complex Engineering Activities (CA), Knowledge Profile (WK), Verbs and Marks/Weightage.**

QUESTION NUMBER	CO	PO-EAC	PO-KPT	BT	BT VERB	CP OR CA	LEVEL OF CP, CA, WK			MARKS/ WEIGHTAGE
							CP (WP1 –WP7)	CA (EA1 – EA5)	WK (WK1 – WK8)	
1	CO1	PO3	PO3	BT3	Apply	CP	WP1	-	WK1, WK3, Wk5	100%
2	CO2	PO3	PO3	BT3	Apply	CP	WP1	-	WK1, WK3,Wk5	100%
3	CO3	PO3	PO3	BT3	Apply	CP	WP1	-	WK1, WK3,Wk5	100%
4	CO2	PO3	PO3	BT3	Apply	CP	WP1	-	WK1, WK3,Wk5	100%

PO6

*Notes:

i. Each question must be mapped to one (1) CO and one (1) PO-EAC and one (1) PO-KPT.
ii. For BT, write the highest level of Bloom Taxonomy (BT1 to BT6) to be evaluated.
iii. For BT Verb, write either "Remember" for BT1, "Understand" for BT2, "Apply" for BT3, "Analyze" for BT4, "Evaluate" for BT5, or "Create" for BT6.
iv. If the question evaluates PO1 to PO7 and PO10, then the minimum BT is BT3
v. If the question evaluates PO1 (EAC) to PO7, then the level of CP and WK must be set. CP MUST have WP1 AND some or all WP2 to WP7 (3 WPs or more). WP1 must have one or more of WK3, WK4, WK5, WK6 or WK8. PO1 & PO2 (WK1 – WK4), PO3 (WK5), PO4 (WK8), PO5 (WK6), PO6 – PO8 (WK7)
vi. If the question evaluates PO10 (EAC), then the level of CA must be set.

PART B1: STANDARD OF QUESTIONS & SOLUTIONS – to be completed by the lecturers and vetters

Vetter 1: AP. Dr. Dzati Athiar Ramli

I. CLARITY AND APPROPRIATENESS OF THE QUESTIONS		Tick 'V' if Yes or cross 'x' if No					
		Q1	Q2	Q3	Q4	Q5	Q6
1	The questions are written clearly.	✓	✓	✓	✓		
2	The questions are aligned with the CO	✓	✓	✓	✓		
3	The question addresses CP and CA	✓	✓	✓	✓		
4	The question reflects the level of CP (i.e. WP) or CA (i.e. EA)	X Please check the WP criteria	X	X	X		
5	The question reflects the level of WK	✓	✓	✓	✓		
6	The questions are set at the appropriate difficulty level based on the taxonomy	✓	✓	✓	✓		
7	The question reflects the level of BT	✓	✓	✓	✓		
8	There is no repetition in the questions	✓	✓	✓	✓		
9	Allocation of marks are correct	✓	✓	✓	✓		
10	The number of items is appropriate with the exam duration	✓	✓	✓	✓		
11	The marking scheme matches with the questions	✓	✓	✓	✓		
12	The question is up to undergraduate level	✓	✓	✓	✓		
II.	TECHNICALITIES AND LANGUAGE						
13	The instruction is clear	✓	✓	✓	✓		
14	Grammar and spelling are correct	✓	✓	✓	✓		
15	Correct terminology is used.	✓	✓	✓	✓		
16	Translations (if any) are appropriate	✓	✓	✓	✓		
17	Diagrams and tables (if any) are clearly labelled and referred to in the question	✓	✓	X	✓		
18	Appendices (if any) are attached to the exam paper	–	–	–	–		
19	Formatting is correct	✓	X	X	✓		

Specific comments about standard of the question:

Vetter 1	Lecturer's Feedback
Please check the WP criteria. (CWP1 and some/all WP2 to WP7) (3 WPs or more) Please check the ~~comm~~ formatting – spacing Please standardize the spacing for all questions All questions are up to undergraduate level.	

Vetter 2:

I. CLARITY AND APPROPRIATENESS OF THE QUESTIONS		Tick '√' if Yes or cross 'x' if No					
		Q1	Q2	Q3	Q4	Q5	Q6
1	The questions are written clearly.	✓	✓	✓	✓		
2	The questions are aligned with the CO	✓	✓	✓	✓		
3	The question addresses CP and CA	✓	✓	✓	✓		
4	The question reflects the level of CP (i.e. WP) or CA (i.e. EA)	✓	✓	✓	✓		
5	The question reflects the level of WK	–	✓	✓	✓		
6	The questions are set at the appropriate difficulty level based on the taxonomy	✓	✓	✓	✓		
7	The question reflects the level of BT	✓	✓	✓	✓		
8	There is no repetition in the questions	✓	✓	✓	✓		
9	Allocation of marks are correct	✓	✓	✓	✓		
10	The number of items is appropriate with the exam duration	✓	✓	✓	✓		
11	The marking scheme matches with the questions	✓	✓	✓	✓		
12	The question is up to undergraduate level	✓	✓	✓	✓		
II.	TECHNICALITIES AND LANGUAGE						
13	The instruction is clear	✓	✓	✓	✓		
14	Grammar and spelling are correct	✓	✓	✓	✓		
15	Correct terminology is used.	✓	✓	✓	✓		
16	Translations (if any) are appropriate	✓	✓	✓	✓		
17	Diagrams and tables (if any) are clearly labelled and referred to in the question	✓	✓	✓	✓		
18	Appendices (if any) are attached to the exam paper	–	–	–	–		
19	Formatting is correct	✓	✓	✓	✓		

Specific comments about standard of the question:

Vetter 2	Lecturer's Feedback
The questions are suitable and are up to undergraduate level	

PART B2: CORRECTIONS AND MODIFICATIONS ON QUESTIONS

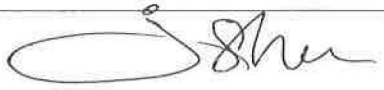
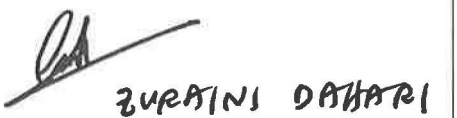
Comments and Suggestions from Vetter 1:

Question	Vetter 1	Lecturer's Feedback
1	As stated in exam question	Corrected as suggested - ZD
2	As stated in exam question	
3	As stated in exam question	
4	As stated in exam question Please check how POG is evaluated (Engineering + Society) Please add term/context related to Engineer + Society.	Noted. Will add some descriptions to relate the assessment to POG, i.e, ethic.
5		
6		

Comments and Suggestions from Vetter 2:

Question	Vetter 2	Lecturer's Feedback
1	- Check the formatting. Especially the indentations.	Corrected as suggested. (ZD)
2	- Check the formatting. Especially the indentations.	
3	- Check the formatting. Especially the spacings. - Standardize the indentations for all questions.	
4	- Indentations not consistent. - In the question text for question 4(b) and 4(c), Table 4(a) is written with subscript to the letter (a). Please correct.	Noted on this.
5		
6		

SIGNATURE:

Lecturers / Vetter	Signature	Date
Course Leader		
Lecturer 2		7/12/22
Lecturer 3		20/11/2022
Vetter 1		23.11.2022
Vetter 2		23/11/2022
Program Chairman		8/12/2022

PERAKUAN KERAHSIAAN MAKLUMAT PEPERIKSAAN

PERAKUAN

Saya/kami seperti nama di bawah dengan ini mengesahkan bahawa saya/kami akan melaksanakan tanggungjawab saya/kami sebagai staf USM yang beretika dan berintegriti dengan merahsiakan segala maklumat, dokumen atau bahan yang berkaitan dengan sebarang urusan penilaian dan peperiksaan di Universiti ini.

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PEPERIKSAAN	Akhir semester		
SEMESTER	**1**	**SIDANG AKADEMIK**	**2022/2023**
KURSUS	**EEE382**		

NO	NAMA	NO. STAF	TANDATANGAN
1	**Dr. Aeizaal Azman Abdul Wahab**	**AE50233**	
2	**Dr. Teh Jiashen**		
3	**AP Dr. Zuraini Dahari**		
4	AP. Dr. Dzati Athiar Ramli	AE 50205	
5	Dr. Muhammad Najwan Hamidi	0832 /21	
6			

NO	SAKSI	NO. STAF	TANDATANGAN
1	PM DR HAIDI BIN IBRAHIM	AE50286	

NOTA

Borang ini hendaklah ditandatangani oleh semua staf yang terlibat dengan penyediaan kertas peperiksaan dan bahan peperiksaan pada setiap semester di Pusat Pengajian PPE Universiti Sains Malaysia

PENGESAHAN

.....

(JAWATAN: ASSOCIATE PROFESSOR Ir. Dr. ROSMIWATI MOHD MOKHTAR
) Deputy Dean
(Academic, Career and International)
School of Electrical and Electronic Engineering
Engineering Campus
Universiti Sains Malaysia

TARIKH : 5/12/22

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School/Centre: _____

DECLARATION :

I/we hereby declare that as a responsible staff of USM, I/we will maintain, with full integrity, the strictest secrecy and confidentiality and not disclose any documents or materials relevant to any assessment and examination related information of this University.

I/We am/are bound by the rules of the examination and related acts from time to time. I/we also acknowledge that if I/we do not fully commit to the assigned task, I/we am/are in breach of the established rules and I/We am/are considered negligent in carrying out the task. Therefore, decisive action can be taken against me/us.

TYPE OF EXAMINATION	End of Semester		
SEMESTER	**1**	**ACADEMIC SESSION**	**2022/2023**
COURSE	**EEE382**		

NO	NAME	STAFF ID	SIGNATURE
1	**Dr. Aeizaal Azman Abdul Wahab**	**AE50233**	
2	**Dr. Teh Jiashen**		
3	**AP Dr. Zuraini Dahari**		
4	AP. Dr. Dzati Athiar Romi	AE 50205	
5	Dr. Muhammad Najwan Hamidi	0832/21	
6			

NO	WITNESS	STAF ID	SIGNATURE
1	PM DR HAIDI BIN IBRAHIM	AE50286	

Note

This form must be signed by all staff involved in the preparation of papers and examination materials every semester at the School/Centre _____ Universiti Sains Malaysia

ENDORSED BY

.....

(POSITION:)

DATE :

UNIVERSITI SAINS MALAYSIA

First Semester Examination
2022/2023 Academic Session

February 2023

EEE382 – PROBABILITY AND ENGINEERING STATISTICS

(KEBARANGKALIAN DAN STATISTIK KEJURUTERAAN)

SOLUTION

Q1 (a)

(i) 100 visits / 60 minutes with } (5)
λt = 5 visits / 3 minutes

$$P(X=0) = \frac{e^{-5}5^0}{0!} \quad \Big\} \ (10)$$

$$= 0.0067$$

(ii) $$P(X>5) = 1 - \sum_{x=0}^{5} \frac{e^{5}5^{x}}{x!} \quad \Big\} \ (15)$$

$$= 1 - 0.6160$$

$$= 0.3840$$

b) $\mu_{\bar{x}_1 - \bar{x}_2} = \mu_1 - \mu_2$ and $\sigma^2_{\bar{x}_1 - \bar{x}_2} = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$

$$\mu_{\bar{x}_1 - \bar{x}_2} = 70 - 28 = 44$$

$$\sigma_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{100}{64} + \frac{25}{100}} \quad \Big\} \ (15)$$

$$= 1.346$$

(b) $$Z = \frac{(44.2 - 44)}{1.346}$$

$$= 0.15$$

$$P(\bar{x}_1 - \bar{x}_2 < 44.2) = P(z < 0.15)$$

$$= 0.5596$$

(15)

(c) (i) The z-score of 9.3 is $\frac{(9.3 - 10)}{1} = -0.70$ — (5)

The z-score of 10.7 is

$$\frac{(10.7 - 10)}{1} = 0.70$$ — (5)

The area between $z = -0.70$ and $z = 0.70$ is $0.7580 - 0.2420 = 0.5160$

The proportion of resistors with resistances between 9.3 and 7 Ω is 0.5160

(5)

(c) (ii) Let X be the number of resistors in the sample whose resistances are between 9.3 and 10.7Ω

From part (i), the probability that a resistor has resistance between 9.3 and 10.7 Ω is 0.5160 (5)

$X \sim \text{Bin}(100, 0.5160)$ so

$\mu_X = 100(0.5160) = 51.60$ — (5)

$\sigma_X = \sqrt{100(0.5160)(0.4840}$ — (5)

$= 4.99744$

$P(X \geq 50)$, use the continuity correction and find the z-score for 49.5

The z-score of 49.5 is (10)

$$\frac{(49.5 - 51.6)}{4.99744} = -0.42$$

$P(X \geq 50) = 0.6628$

Question 2

(a) (i) $H_0 : \mu = 5$
$H_1 : \mu \neq 5$ } (5)

(ii) $H_0 : \mu \leq 6$
$H_1 : \mu > 6$ } (5)

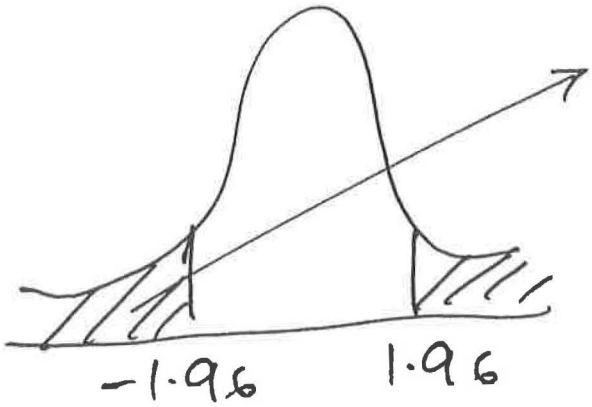
(b) $\bar{x} = 98.2\,^{\circ}C$ $\quad s = 0.62\,^{\circ}C$

$\alpha = 0.05$ $\quad n = 106$

$H_0 : \mu = 98.6$
$H_1 : \mu \neq 98.6$ } (2)

$$Z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{98.2 - 98.6}{0.62/\sqrt{106}} = -6.64$$ } (5)

$Z_{\alpha/2} = 1.96$



Reject H_0

Conclusion :

Mean body temperature not equal to 98.6 .

(3)

(c) $\bar{x} = 98.2°C$ $\quad s = 0.62°C$

$\alpha = 0.05$ $\quad n = 25$

$H_0 : \mu_0 = 98.6$

$H_1 : \mu_0 \neq 98.6$

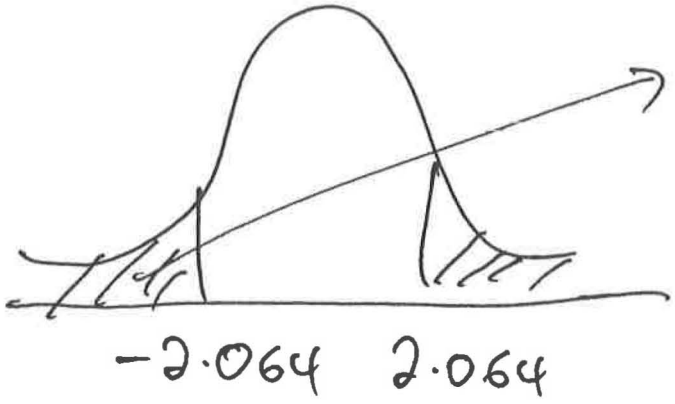
$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{98.2 - 98.6}{0.62/\sqrt{25}}$$

$$= -3.226$$

(5)

$\alpha = 0.05 \quad v = 25 - 1 = 24$

$t_{\alpha/2, v} = 2.064$



(3)

Reject H_0

Conclusion $\mu_0 \neq 98.6$

(2)

2 (d)

$n_y = 100$ $\quad n_x = 100$

$\bar{y} = 190$ $\quad \bar{x} = 200$

$S_y = 20$ $\quad S_x = 40$

$H_0: \mu_x - \mu_y \geq 7$

$H_1: \mu_x - \mu_y < 7$ } (5)

$$Z = \frac{(\bar{x} - \bar{y}) - \Delta x}{\sqrt{\frac{\sigma_x^2}{n_x} + \frac{\sigma_y^2}{n_y}}} = \frac{(200 - 190) - 7}{\sqrt{\frac{40^2}{100} + \frac{20^2}{100}}}$$ } (10)

$$= 0.6708$$

$\alpha = 0.05$ $\quad Z_{0.05} = 1.645$

(10)

Do not reject H_0

$\therefore \mu_x - \mu_x \geq 7$ } (5)

2 (e)

$\bar{X} = 23.13$

$\bar{Y} = 24.617$

$S_x^2 = 14.63$

$S_x = 3.825$

$S_y^2 = 17.894$

$S_y = 4.23$

(12)

$H_0 : \mu_x - \mu_y = 0$

$H_1 : \mu_x - \mu_y \neq 0$

(3)

$$t = \frac{(\bar{x} - \bar{y}) - (\mu_x - \mu_y)}{\sqrt{\frac{S_x^2}{n_x} + \frac{S_y^2}{n_y}}}$$

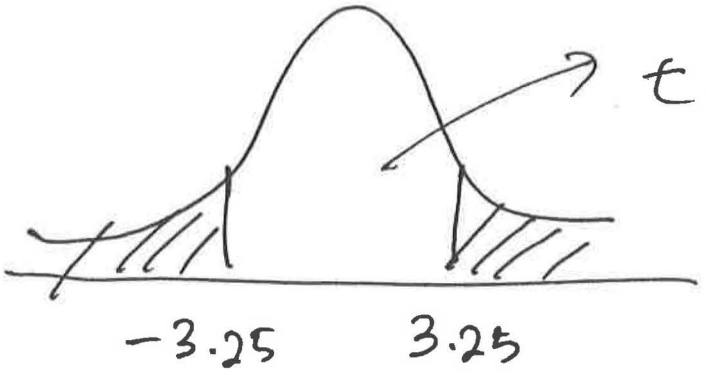
(5)

$= 0.6485$

$$V = \frac{\left(\frac{3.8^2}{6} + \frac{4.2^2}{6}\right)^2}{\frac{\left(\frac{3.8^2}{6}\right)^2}{5} + \frac{\left(\frac{4.2^2}{6}\right)^2}{5}}$$

$= 9$ — (5)

$\alpha = 0.01 \quad t_{0.005, 9} = 3.25$ — (5)



(10)

Do not reject H_0

$\mu_x = \mu_y$

Q (3)

(a) $H_0 : \mu_x = \mu_y$

$H_1 : \mu_x \neq \mu_y$ } (5)

Value	Rank	Sample
12	1	x
13	2	x
15	3	x
18	4	y
19	5	x
20	6	x
21	7	x
23	8	y
24	9	y
27	10	x
30	11	y
32	12	y
35	13	y
40	14	y

(20)

$W = 1+2+3+5+6+7+10 = 34$ } (5)

$T_L = 37 \quad T_U = 68$

$W < T_L$

Reject H_0 } (5)

$\mu_x \neq \mu_y$

Q 3

(b) $H_0: \mu = 3.62$

$H_1: \mu \neq 3.62$

Location	Tire Thread Depth	$x - \mu_0$	Rank
1	3.95	0.33	6
2	3.23	-0.39	-7
3	3.60	-0.02	-1
4	3.48	-0.14	-3
5	3.89	0.27	5
6	3.75	0.13	2
7	3.45	-0.17	-4

(25)

$S = \min(13, 15)$ } (5)

$= 13$

$n = 7$, $\alpha = 0.05$ Critical value = 2 } (5)

$\therefore$ $S > CV$

Do not reject H_0

$\mu = 3.62$

Q 3

(c)

Patient	Blood Pressure	$x - \mu_0$	Rank
1	124	-7	-8
2	132	1	2
3	120	-11	-9
4	125	-6	-7
5	127	-4	-5.5
6	131	0	—
7	132	1	2
8	128	-3	-4
9	127	-4	-5.5
10	130	-1	-2

30

Question 4

(a)

$\sum_{i=1}^{33} x_i = 1104$ $\sum_{i=1}^{33} y_i = 1124$ $\sum_{i=1}^{33} x_i y_i = 41{,}355$ $\sum_{i=1}^{33} x_i^2 = 41{,}086$

$$\beta = \frac{(33)(41{,}355) - (1104)(1124)}{(33)(41{,}086) - (1104)^2} = 0.903643$$

$$\alpha = \frac{1124 - (0.903643)(1104)}{33} = 3.829633$$

$$\hat{y} = 3.8296 + 0.9036x$$

(b)

$S_{xx} = 4152.18$ $S_{xy} = 3752.09$ $S_{yy} = 3713.88$

$$s^2 = \frac{S_{yy} - bS_{xy}}{n-2} = \frac{3713.88 - (0.903643)(3752.09)}{31} = 10.4299$$

$s = 3.2295$

$t_{0.025} = 2.045$

$$0.906343 - \frac{(2.045)(3.2295)}{\sqrt{4152.18}} < \beta < 0.903643 + \frac{(2.045)(3.2295)}{\sqrt{4152.18}}$$

$$0.8012 < \beta < 1.0061$$

(c)

$S_{xx} = 4152.18$ $s = 3.2295$

$$3.829633 - \frac{(2.045)(3.2295)\sqrt{4152.18}}{\sqrt{(33)4152.18}} < \alpha < 3.829633 + \frac{(2.045)(3.2295)\sqrt{4152.18}}{\sqrt{(33)4152.18}}$$

$$0.2132 < \alpha < 7.4461$$

(d)

$S_{xx} = 4152.18$ $s = 3.2295$ $x_0 = 20$ $\bar{x} = 33.4545$ $\hat{y}_0 = 21.9025$

5

$$21.9025 - (2.045)(3.2295)\sqrt{1 + \frac{1}{33} + \frac{(20 - 33.4545)^2}{4152.18}} < y_0$$

$$< 21.9025 + (2.045)(3.2295)\sqrt{1 + \frac{1}{33} + \frac{(20 - 33.4545)^2}{4152.18}}$$

$$15.0585 < y_0 < 28.7464$$

5

5

16 **Muka Surat**
16 Pages

UNIVERSITI SAINS MALAYSIA

BUKU JAWAPAN / *ANSWER BOOKLET*

No. Meja : 42
Desk Number

Angka Giliran : Lima Kosong ~~Kosong~~ Lapan Kosong Lapan Kosong — 50880
Index Number — **Dengan Perkataan**/*In Words* — **Dengan Angka**/*In Figures*

Tajuk Kursus : Probability and Engineering Statistics
Subject Title — **Sebagaimana tercetak pada Kertas Soalan**/*As printed in the Question Paper*

M

Kod Kursus : EEE382
Subject Code

Tempat/Pusat Peperiksaan : Dewan Serbaguna — **Tarikh** : 16 February 2023 — **Pagi/Petang**
Examination Venue/Centre — *Date* — *Morning/Afternoon*

ARAHAN KEPADA CALON / *INSTRUCTIONS TO CANDIDATE*

1. **Isikan ruangan kosong di atas sebelum memulakan jawapan. Jangan tulis nama anda di mana-mana bahagian dalam buku jawapan tambahan ini.**
   Before answering the questions, complete the blank spaces above. Do not write your name anywhere in this supplementary answer booklet.
2. **Tuliskan Angka Giliran anda menggunakan perkataan dan juga angka.**
   Write your index number in words and also in figures.
3. **Draf jawapan boleh dibuat dalam buku jawapan tambahan ini. Coretkan sebarang jawapan yang anda tidak mahu diperiksa.**
   Draft answers may be made in this supplementary answer booklet. Please cross out any answers that you do not wish to be corrected.
4. **Tuliskan jawapan di kedua-dua belah helaian buku jawapan tambahan ini.**
   Write your answers on both sides of the this supplementary answer booklet.
5. **Mulakan menjawab soalan pada helaian baru.**
   Answer each question on a new sheet.
6. **Tuliskan nombor soalan di bahagian atas setiap helaian.**
   Write the question number on the top of every sheet.
7. **Jangan ceraikan sebarang helaian daripada buku jawapan tambahan ini.**
   Do not detach any sheet from this supplementary answer booklet.
8. **Ikatkan buku jawapan tambahan ini bersama dengan buku jawapan.**
   Tie this supplementary answer booklet to answer booklet.
9. **Jangan bawa keluar buku jawapan tambahan ini dan kertas-kertas lain sama ada yang telah digunakan atau belum dari Dewan Peperiksaan.**
   Do not bring this supplementary booklet or any used/unused sheets out of the examination hall.

Nombor Soalan *Question Number*	**Untuk Kegunaan Pemeriksa Sahaja** *For Examiner's Use Only*
	Markah / *Marks*
1	45
2	50
3	80
4	40
JUMLAH *Total*	

RANCANGAN PENGAJIAN : Electronic Engineering
PROGRAMME OF STUDY

TAHUN PENGAJIAN : Three
YEAR OF STUDY

UNIVERSITI SAINS MALAYSIA

H

Jangan tulis di atas ruangan ini
Do not write in this column

No. Soalan : 1
Question No

50880

a) i) 60 min = 100

3 min = 5 $\mu = 5$

$P(X=0) = p(0;5)$

$= 6.7379 \times 10^{-3}$

$= 0.0067$

ii) 60 min = 100 $\mu = 5$

3 min = 5

$P(X>5) = 1 - P(X \leq 5)$

$= 1 - \sum_{x=0}^{5} p(x;5)$

$= 1 - 0.6160$

$= 0.384$

30

No. Soalan 1
Question No

50880

H

Jangan tulis di atas ruangan ini
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Q1

45

c)i) $\mu = 10$ $\quad P(9.3 \leq x \leq 10.7) = P(9.3 \leq z \leq 10.7)$

$\sigma = 1$ $\quad = P(z \leq 10.7) - P(z \leq 9.3)$

$= 0.7580 - 0.2420$

$= 0.516$ *

$P(z \leq 10.7) = z \leq \frac{10.7 - 10}{1}$

$z \leq 0.7$

$= 0.7580$

$P(z \leq 9.3) = z \leq \frac{9.3 - 10}{1}$

$z \leq -0.7$

$= 0.2420$

15

ii)

No Soalan: 2
Question No.

50880

a) i) $H_0: \mu_1 = 5$
$H_1: \mu_1 \neq 5$

ii) $H_0: \mu_2 \geq 6$
$H_1: \mu_2 < 6$

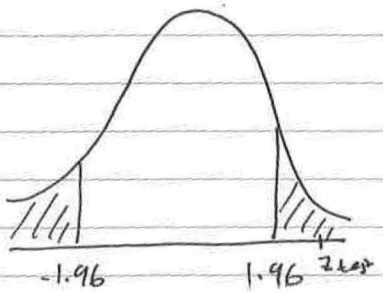
b) $n = 106$
$\mu = 98.2$
$s = 0.62$
$\alpha = 0.05$

$H_0: \mu = 98.6$
$H_1: \mu \neq 98.6$

$$z = \frac{98.6 - 98.2}{\left(\frac{0.62}{\sqrt{106}}\right)}$$

$= 6.6423$

$z_{\frac{\alpha}{2}} = z_{0.025} = 1.96$



Reject H_0
$\mu \neq 98.6$

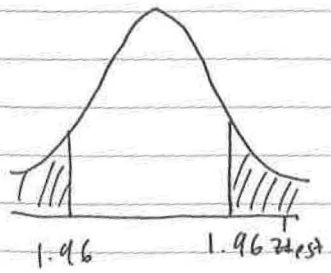
c) $n = 25$
$\mu = 98.2$
$s = 0.62$
$\alpha = 0.05$

$H_0: \mu = 98.6$
$H_1: \mu \neq 98.6$

$$z = \frac{98.6 - 98.2}{\left(\frac{0.62}{\sqrt{25}}\right)}$$

$= 3.226$

$z_{\frac{\alpha}{2}} = z_{0.025} = 1.96$



Reject H_0
$\mu \neq 98.6$

No. Soalan : 2
Question No

50880

d) $n_1 = 100$ $\bar{X}_1 = 200$ $s_1 = 40$ $H_0 : \mu_1 - \mu_2 < 7$

$n_2 = 100$ $\bar{X}_2 = 190$ $s_2 = 20$ $H_1 : \mu_1 - \mu_2 \geq 7$

$\alpha = 0.05$

unknown and unequal

$$t = \frac{\bar{X}_1 - \bar{X}_2 - 7}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}} = \frac{200 - 190 - 7}{\sqrt{\left(\frac{40^2}{100} + \frac{20^2}{100}\right)}}$$

$$= 0.6708$$

$$v = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{(n_1 - 1)} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{(n_2 - 1)}} = \frac{\left(\frac{40^2}{100} + \frac{20^2}{100}\right)^2}{\frac{\left(\frac{40^2}{100}\right)^2}{(99)} + \frac{\left(\frac{20^2}{100}\right)^2}{(99)}}$$

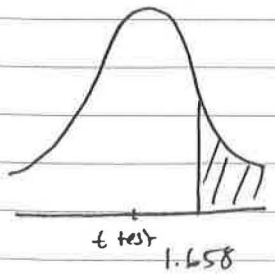
$$= 145.5852$$

$$\approx 146$$

$t_{\alpha, v} = t_{0.05, 146}$

$\approx t_{0.05, 120}$

$= 1.658$



Do not reject H_0

$\mu_1 - \mu_2 < 7$

e) $n_A = 6$ $\bar{X}_A = 23.1333$ $S_A = 3.8245$ $H_0 : \mu_A - \mu_B = 0$

$n_B = 6$ $\bar{X}_B = 24.6167$ $S_B = 4.2301$ $H_1 : \mu_A - \mu_B \neq 0$

$\alpha = 0.01$

Unknown and equal

$$t = \frac{\bar{X}_A - \bar{X}_B}{S_p\sqrt{\frac{1}{n_A} + \frac{1}{n_B}}} = \frac{23.1333 - 24.6167}{4.0324\sqrt{\frac{1}{6} + \frac{1}{6}}} = -0.6372$$

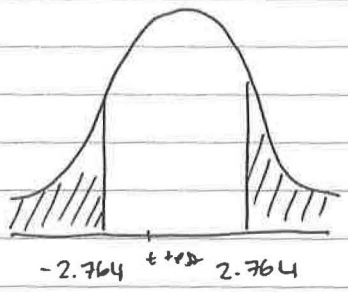
$$S_p = \sqrt{\frac{(n_A - 1)S_A^2 + (n_B - 1)S_B^2}{n_A + n_B - 2}}$$

$$= \sqrt{\frac{(5)(3.8245)^2 + (5)(4.2301)^2}{10}}$$

$$= 4.0324$$

$t_{\frac{\alpha}{2}, n_A + n_B - 2} = t_{0.005, 10}$

$= 2.764$



Do not reject H_0

$\mu_A - \mu_B = 0$

No. Soalan : 3
Question No

50880

H

Jangan tulis di atas ruangan ini
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a) $n_x = 7$ $H_0 : \mu_x = \mu_y$

$n_y = 7$ $H_1 : \mu_x \neq \mu_y$

$\alpha = 0.05$

Value	Rank	Sample
12	1	X
13	2	X
15	3	X
18	4	Y
19	5	X
20	6	X
21	7	X
23	8	Y
24	9	Y
27	10	X
30	11	Y
32	12	Y
35	13	Y
40	14	Y

$W_x = 1 + 2 + 3 + 5 + 6 + 7 + 10$

$= 34$

$T_L = 37$

$W_x < T_L$

Reject ~~H_0~~

$\mu_x \neq \mu_y$

b) $n = 7$ $\quad H_0 : \mu = 3.62$

$\mu = 3.62$ $\quad H_1 : \mu \neq 3.62$

$\alpha = 0.05$

x_i	$x_i - \mu$	$\lvert x_i - \mu \rvert$	Sort $\lvert x_i - \mu \rvert$	Rank
3.95	0.33	0.33	0.02	-1
3.23	-0.39	0.39	0.13	2
3.60	-0.02	0.02	0.14	-3
3.48	-0.14	0.14	0.17	-4
3.89	0.27	0.27	0.27	5
3.75	0.13	0.13	0.33	6
3.45	-0.17	0.17	0.39	-7

$W^- = 1 + 3 + 4 + 7$ $\quad W^+ = 2 + 5 + 6$

$= 15$ $\quad = 13$

$W = \min(W^-, W^+)$

$= \min(15, 13)$

$= 13$

$W_\alpha = W_{0.05} = 2$

$W > W_\alpha$ $\quad \therefore$ Do not reject H_0

$\mu = 3.62$

c) $\mu = 131$ $\quad H_0 : \mu \geq 131$

$n = 16$ $\quad H_1 : \mu < 131$

assume $\alpha = 0.05$

x_i	$x_i - \mu$	$\lvert x_i - \mu \rvert$	Sort $\lvert x_i - \mu \rvert$	Rank
125	-6	6	0	1
132	1	1	1	3
120	-11	11	1	3
125	-6	6	1	-3
127	-4	4	3	-5
131	0	0	4	-6.5
132	1	1	4	-6.5
128	-3	3	6	-8.5
127	-4	4	6	-8.5
130	-1	1	11	-10

$W^+ = 1 + 3 + 3$
$= 7$

$W_\alpha = W_{0.05}$
$= 11$

$W^+ < W_\alpha$

$\therefore$ reject H_0
$\mu < 131$

b) $n = 7$ $\quad H_0 : \mu = 3.62$

$\mu = 3.62$ $\quad H_1 : \mu \neq 3.62$

$\alpha = 0.05$

x_i	$x_i - \mu$	$\lvert x_i - \mu \rvert$	Sort $\lvert x_i - \mu \rvert$	Rank
3.95	0.33	0.33	0.02	-1
3.23	-0.39	0.39	0.13	2
3.60	-0.02	0.02	0.14	-3
3.48	-0.14	0.14	0.17	-4
3.89	0.27	0.27	0.27	5
3.75	0.13	0.13	0.33	6
3.45	-0.17	0.17	0.39	-7

$W^- = 1 + 3 + 4 + 7$ $\quad W^+ = 2 + 5 + 6$

$= 15$ $\quad = 13$

$W = \min(W^-, W^+)$

$= \min(15, 13)$

$= 13$

$W_\alpha = W_{0.05} = 2$

$W > W_\alpha$ $\quad \therefore$ Do not reject H_0

$\mu = 3.62$

$$b = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2} = \frac{(33)(41355) - (1104)(1124)}{(33)(41086) - (1104)^2}$$

$$= 0.9036$$

$$a = \frac{\Sigma y - b\Sigma x}{n} = \frac{(1124) - (0.9036)(1104)}{33}$$

$$= 3.8311$$

$$\hat{y} = a + b\hat{x}$$

$$= 3.8311 + 0.9036\hat{x}$$

b) $100(1-\alpha) = 95$

$\alpha = 0.05$

$$\beta = b \pm t_{\frac{\alpha}{2}}\left(\frac{s}{\sqrt{S_{xx}}}\right)$$

$$t_{\frac{\alpha}{2}, n-2} = t_{0.025, 31} \approx t_{0.025, 30} = 2.042$$

$$s = \sqrt{\frac{S_{yy} - bS_{xy}}{n-2}}$$

$$= \sqrt{\frac{(3113.8788) - (0.9036)(3752.0909)}{31}}$$

$$=$$

$$S_{yy} = \Sigma y^2 - \frac{(\Sigma y)^2}{n}$$

$$= 41398 - \frac{(1124)^2}{33}$$

$$= 3113.8788$$

$$S_{xy} = \Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}$$

$$= 41355 - \frac{(1104)(1124)}{33}$$

$$= 3752.0909$$

$$S_{xx} = \Sigma x^2 - \frac{(\Sigma x)^2}{n}$$

$$= 41086 - \frac{(1104)^2}{33}$$

$$= 4152.1818$$

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BUKU JAWAPAN / *ANSWER BOOKLET*

No. Meja : 180
Desk Number

Angka Giliran : Five One Three One Three — 51313
Index Number — **Dengan Perkataan**/*In Words* — **Dengan Angka**/*In Figures*

Tajuk Kursus : Probability and Engineering Statistics
Subject Title — **Sebagaimana tercetak pada Kertas Soalan**/*As printed in the Question Paper*

Kod Kursus : EEE382
Subject Code

L

Tempat/Pusat Peperiksaan : DSG — **Tarikh :** 16/2/2023 — **Pagi**/Petang
Examination Venue/Centre — *Date* — *Morning/Afternoon*

ARAHAN KEPADA CALON / *INSTRUCTIONS TO CANDIDATE*

1. **Isikan ruangan kosong di atas sebelum memulakan jawapan. Jangan tulis nama anda di mana-mana bahagian dalam buku jawapan tambahan ini.**
   Before answering the questions, complete the blank spaces above. Do not write your name anywhere in this supplementary answer booklet.
2. **Tuliskan Angka Giliran anda menggunakan perkataan dan juga angka.**
   Write your index number in words and also in figures.
3. **Draf jawapan boleh dibuat dalam buku jawapan tambahan ini. Coretkan sebarang jawapan yang anda tidak mahu diperiksa.**
   Draft answers may be made in this supplementary answer booklet. Please cross out any answers that you do not wish to be corrected.
4. **Tuliskan jawapan di kedua-dua belah helaian buku jawapan tambahan ini.**
   Write your answers on both sides of the this supplementary answer booklet.
5. **Mulakan menjawab soalan pada helaian baru.**
   Answer each question on a new sheet.
6. **Tuliskan nombor soalan di bahagian atas setiap helaian.**
   Write the question number on the top of every sheet.
7. **Jangan ceraikan sebarang helaian daripada buku jawapan tambahan ini.**
   Do not detach any sheet from this supplementary answer booklet.
8. **Ikatkan buku jawapan tambahan ini bersama dengan buku jawapan.**
   Tie this supplementary answer booklet to answer booklet.
9. **Jangan bawa keluar buku jawapan tambahan ini dan kertas-kertas lain sama ada yang telah digunakan atau belum dari Dewan Peperiksaan.**
   Do not bring this supplementary booklet or any used/unused sheets out of the examination hall.

Nombor Soalan Question Number	**Untuk Kegunaan Pemeriksa Sahaja** *For Examiner's Use Only* — **Markah** / *Marks*
1	10
2	50
3	40
4.	0
JUMLAH *Total*	

RANCANGAN PENGAJIAN : MECHATRONIC
PROGRAMME OF STUDY

TAHUN PENGAJIAN : 3
YEAR OF STUDY

No. Soalan :
Question No :

H

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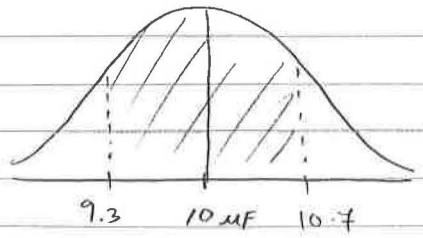
c) (i)



$\sigma = 1 \mu F$

$P(9.3 < X < 10.7) = P(-0.7 < z < 0.7)$

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

$= \frac{9.3 - 10}{1} = -0.7$

$z_2 = \frac{10.7 - 10}{1} = 0.7$

$0.7 \rightarrow 0.7580$

$-0.7 \rightarrow 0.2420$

$= 0.7580 - 0.2420$

$= 0.486$

(ii) $n = 100$

01

10

10

(a)

(i) $H_0 : \mu = 5$

$H_1 : \mu \neq 5$ / 10

(ii) $H_0 : \mu_0 - \mu_1 \geq 6$

$H_1 : \mu_0 - \mu_1 < 6$ ✗

b) $n = 106$

$\bar{x} = 98.2$

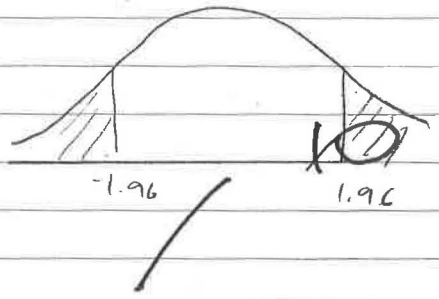
$s = 0.62^\circ C$

$\alpha = 0.05$

$H_0 : \mu = 98.6$ } two-tailed

$H_1 : \mu \neq 98.6$

$$z = \frac{\bar{x} - \mu}{\sqrt{s^2/n}}$$

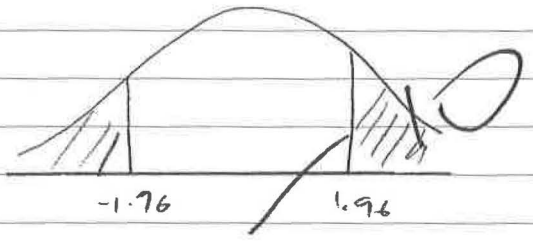


$$= \frac{98.2 - 98.6}{\sqrt{0.62^2/106}}$$

$= -6.64$ is in rejection area,

∴ Hence, reject H_0.

c) $n = 25$



$$T = \frac{\bar{X} - d_0}{\sqrt{\frac{s^2}{n}}}$$

$$= \frac{98.2 - 98.6}{\sqrt{0.62^2/25}}$$

$= -3.23$

No. Soalan :
Question No :

H

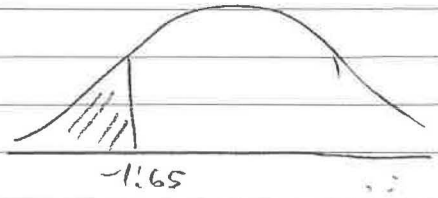
Jangan tulis di atas ruangan ini
Do not write in this column

8

d) ① New	200	40
② old	190	20

$n = 100$ $\quad H_0 : \mu_1 - \mu_2 \geq 7$ } one tailed
$\alpha = 0.05$ $\quad H_1 : \mu_1 - \mu_2 < 7$

$$z = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$



$$= \sqrt{\frac{40^2}{200} + \frac{20^2}{190}}$$

/10

$= 3.18$ is not in rejection area

∴ Hence cannot reject H_0

(a)

x	12	13	15	19	20	21	27
y	18	23	24	30	32	35	40

Sort		
12	1	X
13	2	X
15	3	X
18	4	Y
19	5	X
20	6	X
21	7	X
23	8	Y
24	9	Y
27	10	X
30	11	Y
32	12	Y
35	13	Y
40	14	Y

$W_1 = 1+2+3+5+6+7+10$
$= 24$

$W_2 = 4+8+9+11+12+13+14$
$= 71$

$W_- = \min(W_1, W_2)$
$= \min(24, 71)$
$= \min(W_1)$

$H_0 : \mu_1 = \mu_2$
$H_1 : \mu_1 \neq \mu_2$

$T_\alpha = 37$
$W_1 \leq T_\alpha$

$\therefore$ Reject H_0

b)

x	x − 3.62	|x − 3.62|	Rank	
3.95	0.33	0.33	6	$W^+ = 7+1+3+4$
3.23	−0.39	0.39	7	$= 15$
3.60	−0.02	0.02	1	
3.48	−0.14	0.14	3	$W^+ = 6+5+2$
3.89	0.27	0.27	5	$= 13$
3.75	0.13	0.13	2	
3.45	−0.17	0.17	4	$W = \min(W^-, W^+)$

$= \min(W^+)$
$= 13$

$H_0 : \mu = 3.62$
$H_1 : \mu \neq 3.62$

$\alpha = 0.05$

$W_\alpha = 2$ $\therefore$ Cannot Reject H_0

$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$

$\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}} = \frac{2568.74}{2997.63} = 0.8569$

$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$

$5 = \hat{\beta}_0 + (0.8569)(3)$; $x=3$, $y=5$

$\hat{\beta}_0 = 2.4293$

$\therefore \hat{y} = 2.4293 + 0.8569x$

b) $SS_E = S_{yy} - \hat{\beta}_1 S_{xy}$

$= 2636.74 - (0.8569)(2568.04)$

$= 436.19$

$\hat{\sigma}^2 = \frac{436.19}{27-2}$

$= 17.44$

$\hat{\beta}_1 - t\sqrt{\frac{\sigma^2}{S_{xx}}} < \beta_1 < \hat{\beta}_1 + t\sqrt{\frac{\sigma^2}{S_{xx}}}$

$t = 2.060$

$0.8569 - 2.060\sqrt{\frac{17.44}{2997.63}} = 0.6997 \approx 0.7$

$0.8569 + 2.060\sqrt{\frac{17.44}{2997.63}} = 1.01$

$\therefore 0.7 < \beta_1 < 1.01$

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BUKU JAWAPAN / *ANSWER BOOKLET*

16 **Muka Surat**
16 Pages

No. Meja : 13
Desk Number

Angka Giliran : FIVE ZERO EIGHT TWO ZERO — **Dengan Perkataan**/*In Words* — **Dengan Angka**/*In Figures* 50820
Index Number

Tajuk Kursus : Probability And Engineering Statistics
Subject Title — **Sebagaimana tercetak pada Kertas Soalan**/*As printed in the Question Paper*

Kod Kursus : EEE 382
Subject Code

Tempat/Pusat Peperiksaan : DSG — **Tarikh :** 16/02/2023 — **Pagi/Petang**
Examination Venue/Centre — *Date* — *Morning/Afternoon*

A

ARAHAN KEPADA CALON / *INSTRUCTIONS TO CANDIDATE*

1. **Isikan ruangan kosong di atas sebelum memulakan jawapan. Jangan tulis nama anda di mana-mana bahagian dalam buku jawapan tambahan ini.**
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   Answer each question on a new sheet.
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8. **Ikatkan buku jawapan tambahan ini bersama dengan buku jawapan.**
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9. **Jangan bawa keluar buku jawapan tambahan ini dan kertas-kertas lain sama ada yang telah digunakan atau belum dari Dewan Peperiksaan.**
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Nombor Soalan Question *Number*	**Untuk Kegunaan Pemeriksa Sahaja** *For Examiner's Use Only*
	Markah / *Marks*
1	90
2	60
3	80
4.	100
JUMLAH *Total*	

RANCANGAN PENGAJIAN : ..... — **TAHUN PENGAJIAN :** .....
PROGRAMME OF STUDY — *YEAR OF STUDY*

50820

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No. Soalan : 19)
Question No

H

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1)a) i) $\mu = 100$

$\lambda t = (100)\left(\frac{3}{60}\right) = 5$

$P(X=0) = P(0,5) = \frac{e^{-\lambda t}(\lambda t)^x}{x!}$

$= \frac{e^{-5}(5)^0}{0!}$

$= 6.7379 \times 10^{-3}$

$= 0.006738$

1)a) ii) $P(X>5) = 1 - P(X \leq 5)$, $\lambda t = 5$

$= 1 - 0.6160$

$= 0.384$

30

30820

No. Soalan / Question No: 1b)

Lemon free → 1 $\quad \mu_1 = 72 \quad \sigma_1 = 10 \quad n_1 = 64$

Guava free → 2 $\quad \mu_2 = 28 \quad \sigma_2 = 5 \quad n_2 = 100$

$P(X_1 - X_2 \leq 44.2) = P(X_1 - X_2 \leq 44.2)$

$= P\left(z < \dfrac{44.2 - (72-28)}{\sqrt{\frac{10^2}{64} + \frac{5^2}{100}}}\right)$

$= P(z < 0.1486)$

$= 0.5596$

3

50820

H

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No. Soalan : 1C)
Question No

1c)i) $\mu = 10\ \mu F \quad \sigma = 1\ \mu F$

$$P(9.3 < X < 10.7) = P(X < 10.7) - P(X < 9.3)$$

$$= P\left(Z < \frac{10.7-10}{1}\right) - P\left(Z < \frac{9.3-10}{1}\right)$$

$$= P(Z < 0.7) - P(Z < -0.7)$$

$$= 0.7580 - 0.242$$

$$= 0.516$$

1c)ii) $n = 100 \quad p = 0.516$

$$\sigma^2 = npq = (100)(0.516)(1-0.516)$$

$$\sigma^2 = 24.9744$$

$$\mu = np = (100)(0.516)$$

$$= 51.6$$

$$P(X \geq 50) = 1 - P(X < 50)$$

$$= 1 - P\left(Z < \frac{50 - 0.5 - 51.6}{\sqrt{\frac{24.9744}{100}}}\right)$$

$$= 1 - P(Z < -4.2022)$$

$$= 1 - 0.0001$$

$$= 0.9999$$

50820

H

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No. Soalan : 26
Question No

$n = 106 \quad (> 30)$

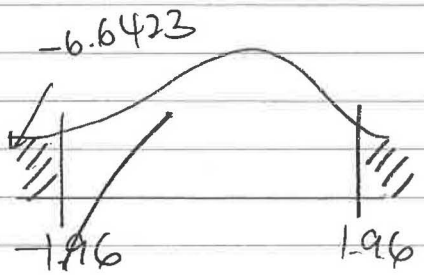
$\bar{x} = 98.2$
$s = 0.62$

$H_0 : \mu = 98.6$
$H_1 : \mu \neq 98.6$

$$z = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$$

$$= \frac{98.2 - 98.6}{\frac{0.62}{\sqrt{106}}}$$

$$= -6.6423$$



∴ Reject H_0. $\mu \neq 98.6$.

No Soalan : 2d
Question No.

H

new batteries → 1
old batteries → 2

$H_0 : \mu_1 - \mu_2 \geq 7$
$H_1 : \mu_1 - \mu_2 < 7$

$n_1 = 100 \quad \mu_1 = 200 \quad S_1 = 40$
$n_2 = 100 \quad \mu_2 = 190 \quad S_2 = 20$

∴ variance unknown and unequal.

$$V = \frac{\left(\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right)^2}{\frac{\left(\frac{S_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{S_2^2}{n_2}\right)^2}{n_2 - 1}} = \frac{\left(\frac{40^2}{100} + \frac{20^2}{100}\right)^2}{\frac{\left(\frac{40^2}{100}\right)^2}{99} + \frac{\left(\frac{20^2}{100}\right)^2}{99}} = 145.5882$$

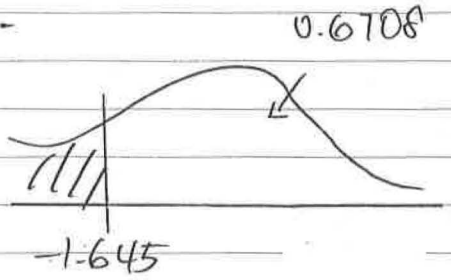
$V \approx 145$

Since V is too large, z is used.

$$z = \frac{\bar{X}_1 - \bar{X}_2 - \Delta x}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

$$= \frac{200 - 190 - 7}{\sqrt{\frac{40^2}{100} + \frac{20^2}{100}}}$$

$= 0.6708$



∴ Do not reject H_0. $\mu_1 - \mu_2 \geq 7$.

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No. Soalan : 2e
Question No

H

Jangan tulis di atas ruangan ini
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Processor A → A $H_0: \mu_A = \mu_B$
Processor B → B $H_1: \mu_A \neq \mu_B$

$\bar{X}_A = 23.1333$ $S_A = 3.8245$ $n_A = 6$
$\bar{X}_B = 24.6167$ $S_B = 4.2301$ $n_B = 6$

∴ variance unknown, and equal.

$$S_p = \sqrt{\frac{(n_A-1)S_A^2 + (n_B-1)S_B^2}{n_A+n_B-2}}$$

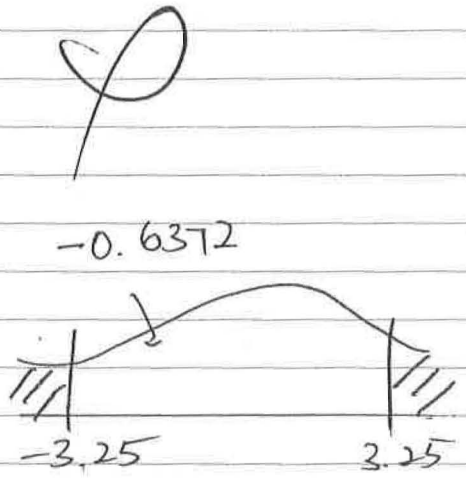
$$= \sqrt{\frac{(6-1)(3.8245)^2 + (6-1)(4.2301)^2}{6+6-2}}$$

$$= 4.0324$$

$$t = \frac{\bar{X}_A - \bar{X}_B}{S_p\sqrt{\frac{1}{n_A} + \frac{1}{n_B}}}$$

$$= \frac{23.1333 - 24.6167}{4.0324\sqrt{\frac{1}{6} + \frac{1}{6}}}$$

$$= -0.6372$$



∴ Do not reject H_0. $\mu_A = \mu_B$.

No. Soalan : 3b
Question No

H

$H_0 : \mu = 3.62$
$H_1 : \mu \neq 3.62$

X_i	$X_i - \mu$	$\lvert X_i - \mu \rvert$	sort $\lvert X_i - \mu \rvert$	Rank
3.95	0.33	0.33	0.02	-1
3.23	-0.39	0.39	0.13	2
3.60	-0.02	0.02	0.14	-3
3.48	-0.14	0.14	0.17	-4
3.89	0.27	0.27	0.27	5
3.75	0.13	0.13	0.33	6
3.45	-0.17	0.17	0.39	-7

$W^+ = 2+5+6$
$= 13$

$W^- = 1+3+4+7$
$= 15$

$W_{min} = W^+ = 13 = W$
$W_\alpha = 2$

$\therefore W > W_\alpha$. Do not reject Ho. $\mu = 3.62$

50820

H

Jangan tulis di atas ruangan ini
Do not write in this column

No. Soalan : 3c
Question No

$H_0: \mu \geq 131$
$H_1: \mu < 131$

let X = systolic Blood Pressure (mmHg)

X_i	$X_i - \mu$	$\lvert X_i - \mu \rvert$	Sort $\lvert X_i - \mu \rvert$	Rank
125	−6	6	0	1
132	1	1	1	−3
120	−11	11	1	3
125	−6	6	1	3
127	−4	4	3	−5
131	0	0	4	−6.5
132	1	1	4	−6.5
128	−3	3	6	−8.5
127	−4	4	6	−8.5
130	−1	1	11	−10

$W^+ = 1+3+3$
$= 7$

$W_\alpha = 11$

$\therefore W^+ < W_\alpha$, reject H_0. $\mu < 131$.

50820

No. Soalan / Question No.: 4a

H

Jangan tulis di atas ruangan ini
Do not write in this column

Power input, x	Power output, y	xy	x^2	y^2
3	5	15	9	25
7	11	77	49	121
11	21	231	121	441
15	16	240	225	256
18	16	288	324	256
27	28	756	729	784
29	27	783	841	729
30	25	750	900	625
30	35	1050	900	1225
31	30	930	961	900
31	40	1240	961	1600
32	32	1024	1024	1024
33	34	1122	1089	1156
33	32	1056	1089	1024
34	34	1156	1156	1156
36	37	1332	1296	1369
36	38	1368	1296	1444
36	34	1224	1296	1156
37	36	1332	1396	1296
38	38	1444	1444	1444
39	37	1443	1521	1369
39	36	1404	1521	1296
39	45	1755	1521	2025
40	39	1560	1600	1521
41	41	1681	1681	1681
42	40	1680	1764	1600
42	44	1848	1764	1936
43	37	1591	1849	1369
44	44	1936	1936	1936
45	46	2070	2025	2116
46	46	2116	2116	2116
47	49	2303	2209	2401
50	51	2550	2500	2601
$\Sigma = 1104$	$\Sigma = 1124$	$\Sigma = 41355$	$\Sigma = 41086$	$\Sigma = 41998$

$n = 33$

$\bar{x} = \frac{1104}{33} = 33.4545$ $\quad \bar{y} = \frac{1124}{33} = 34.0606$

No. Soalan : 4b
Question No

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95% confidence interval for β, $\mu_{Y/x} = \alpha + \beta x$.

$$b_1 - t_{\alpha/2}\frac{s}{\sqrt{S_{xx}}} < \beta < b_1 + t_{\alpha/2}\frac{s}{\sqrt{S_{xx}}}$$

$$S_{xx} = \Sigma x^2 - n.(\bar{x})^2$$
$$= 41086 - 33(33.4545)^2$$
$$= 4152.2822$$

$$S_{yy} = \Sigma y^2 - n(\bar{y})^2$$
$$= 41998 - 33(34.0606)^2$$
$$= 3713.8924$$

$$S_{xy} = \Sigma xy - n(\bar{x})(\bar{y})$$
$$= 41355 - 33(33.4545)(34.0606)$$
$$= 3752.1487$$

$$s^2 = \frac{S_{yy} - b_1 S_{xy}}{n-2}$$

$$= \frac{3713.8924 - 0.9036(3752.1487)}{33-2}$$

$$= 10.4339$$

$$s = \sqrt{10.4339}$$
$$= 3.2302$$

$t_{\alpha/2, n-2} = t_{0.025, 31}$
$= 2.042$

$b_1 = 0.9036$

95% confidence interval for β,

$$0.9036 - 2.042\left(\frac{3.2302}{\sqrt{4152.2822}}\right) < \beta < 0.9036 + 2.042\left(\frac{3.2302}{\sqrt{4152.2822}}\right)$$

$$0.8012 < \beta < 1.0060$$

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No. Soalan / Question No. 4C

95% confidence Interval for α

$$b_0 - t_{\alpha/2}\frac{s}{\sqrt{n.S_{xx}}}\sqrt{\Sigma x^2} < \alpha < b_0 + t_{\alpha/2}\frac{s}{\sqrt{nS_{xx}}}\sqrt{\Sigma x^2}$$

$$3.8311 - 2.042\left(\frac{3.2302}{\sqrt{33(4152.2822)}}\right)\sqrt{41086} < \alpha < 3.8311 + \frac{(2.042)(3.2302)}{\sqrt{33(4152.2822)}}\sqrt{41086}$$

$$0.2175 < \alpha < 7.4447$$

✓ 10