



First Semester Examination
2019/2020 Academic Session

December 2019 / January 2020

EMT 211 – Engineering Probability & Statistics
[Kebarangkalian & Statistik Kejuruteraan]

Duration : 3 hours
[Masa : 3 jam]

Please check that this paper contains **SEVEN (7)** printed pages including appendix before you begin the examination.

*[Sila pastikan bahawa kertas soalan ini mengandungi **TUJUH [7]** mukasurat bercetak beserta lampiran sebelum anda memulakan peperiksaan.]*

INSTRUCTIONS : Answer **ALL FIVE [5]** questions.
*[**ARAHAN** : Jawab **SEMUA LIMA [5]** soalan.]*

Answer Questions In **English OR Bahasa Malaysia**.
*[Jawab soalan dalam **Bahasa Inggeris** ATAU **Bahasa Malaysia**.]*

Answer to each question must begin from a new page.
[Jawapan bagi setiap soalan mestilah dimulakan pada mukasurat yang baru.]

In the event of any discrepancies, the English version shall be used.
[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]

1. [a] Prove the following using the Algebra of sets.

Buktikan berikut menggunakan set Algebra.

$$(B \cap A')' \cap (A')' = A$$

(4 marks/markah)

- [b] A lecturer has two outstanding students in Statistics course. One of the students who was seen having discussion with the lecturer is a female. What is the probability that both the outstanding students are females?

Seorang pensyarah mempunyai dua pelajar hebat dalam kursus Statistik. Salah seorang pelajar yang kelihatan sedang berbincang dengan pensyarah itu ialah pelajar perempuan. Apakah kebarangkalian bahawa pelajar-pelajar hebat kedua-duanya perempuan?

(6 marks/markah)

- [c] Suppose a restaurant manager keeps track of how many customers in a week ask for Chilli sauce and/or Ketchup with their burgers. The results are tabulated as follows.

Andaikan bahawa pengurus restoran memantau bilangan pelanggan-pelanggannya yang meminta sos cili dan/atau tomato untuk burger mereka dalam tempoh satu minggu. Keputusan dijadualkan seperti berikut.

	Chilli/ Cili	No Chilli/ Tiada cili	Total/ Jumlah
Ketchup/ Tomato	50	150	200
No Ketchup/ Tiada Tomato	200	100	300
Total	250	250	500

- (i) Represent the tabulated data in the form of Venn diagram.
Wakili data yang diberi dengan gambarajah Venn.

- (ii) Find
Dapatkan

- $P(\text{Chilli/Ketchup})$
- $P(\text{Cili/Tomato})$

- (iii) Determine if Ketchup and Chilli sauce is independent.

Tentukan sama ada sos Tomato dan Cili adalah saling tidak bersandar.

(10 marks/markah)

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SULIT

2. [a] The score (%) obtained by a group of female students in a quiz is shown in Figure 1.

Skor (%) yang diperoleh sekumpulan pelajar perempuan dalam suatu kuiz ditunjukkan dalam Rajah 1.

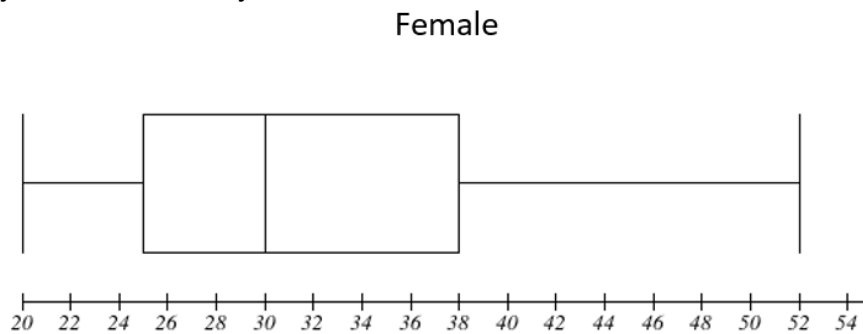


Figure 1
Rajah 1

- (i) List the five-number summary represented by the boxplot in Figure 1.

Senaraikan rumusan lima nombor yang diwakili oleh gambarajah kotak pada Rajah 1.

(5 marks/markah)

- (ii) The scores obtained by the male students are summarized in the following stem and leaf plot. Find the mean, median and mode of the male scores.

Nilai skor yang diperoleh sekumpulan pelajar lelaki diringkaskan dalam gambarajah tangkai dan daun. Cari nilai-nilai min, median dan mod bagi skor pelajar lelaki.

(5 marks/markah)

Stem	Leaf
1	4
2	6
3	4 4 7
4	0 6 6 7 7 8
5	0 0 1 1 1 3 6 7 7
6	2 2 3 3 3 8
7	0 0 8
8	5
9	0

- [b] Sketch a box plot of male students' scores side by side with the female students' scores indicating clearly if there are any outliers.

Lakarkan suatu plot kotak bagi skor pelajar lelaki bersebelahan dengan skor pelajar perempuan. Tunjukkan dengan jelas sekiranya ada nilai-nilai terpencil.

(5 marks/markah)

- [c] Compare the score distributions between the male and female students. Explain whether there are any unusual features in the data observed.

Bandingkan taburan skor antara pelajar-pelajar lelaki dan perempuan. Terangkan sama ada unsur-unsur ganjil dalam data yang dilihat.

(5 marks/markah)

3. [a] On average, there was about 90% of guests who arrived at a hotel were given rooms on reservations. The hotel has 200 rooms and 215 reservations were made for one-night accommodation. The problem is to find the probability that all guests were accommodated in a particular night. If X = number of guests arriving at the hotel, find the probability that all rooms can be occupied using

Secara purata, terdapat kira-kira 90% daripada pelanggan yang sampai di hotel diberi bilik melalui tempahan. Hotel itu mempunyai 200 bilik dan 215 tempahan telah dibuat untuk penginapan 1 malam. Masalahnya adalah untuk mencari kebarangkalian bahawa pelanggan mendapat penginapan pada suatu malam. Jika X = bilangan pelanggan yang sampai di hotel, cari kebarangkalian bahawa kesemua bilik penginapan dipenuhi dengan

- (i) **Binomial distribution.**

Taburan Binomial.

- (ii) **The normal approximation to the Binomial distribution.**

Anggaran normal kepada taburan Binomial.

- (iii) **State TWO (2) assumptions for a good normal approximation to the Binomial distribution.**

Nyatakan DUA (2) anggapan bagi suatu anggaran normal kepada taburan Binomial.

(10 marks/markah)

- [b] The CEO of a mobile company claims that 80% of his 1,000,000 customers are happy with the service they receive. The local newspaper conducted a survey by selecting 100 customers at random. Among the sampled customers, 73% say they are happy. Based on these findings can we reject the CEO's hypothesis that 80% of the customers are happy at 0.05 level of significance?

CEO sebuah syarikat telefon menyatakan bahawa sebanyak 80% daripada 1,000,000 orang pelanggannya adalah gembira dengan perkhidmatan yang mereka terima. Sebuah akhbar tempatan membuat suatu kajian dengan memilih 100 orang pelanggan secara rawak. Antara sampel pelanggan yang dikaji, 73% mengatakan bahawa mereka adalah gembira. Berdasarkan keputusan ini, bolehkan kita menafikan hipotesis CEO bahawa 80% daripada pelanggan adalah gembira pada aras keyakinan 0.05?

(10 marks/markah)

4. [a] The correlation coefficient r between the tensile strength and load for 35 samples of recycled aluminium was computed to be 0.78. Find the 0.05 confidence limits for this coefficient.

Pekali korelasi r antara kekuatan regangan dan beban untuk 35 sampel aluminium kitar semula telah dikira sebanyak 0.78. Kirakan batas keyakinan 0.05 bagi pekali ini.

Given:

Diberi:

$$z = \frac{(\bar{x} - \mu)}{(\sigma/\sqrt{N})} = 1.1513 \log \frac{(1+r)}{(1-r)}$$

and

dan

$$\sigma z = \left(\frac{1}{\sqrt{N-3}} \right)$$

(4 marks/markah)

- [b] Two correlation coefficients obtained from samples of sizes $N_1 = 24$ and $N_2 = 30$ were computed to be $r_1 = 0.70$ and $r_2 = 0.25$, respectively. Is there a significant difference between the two coefficients at the 0.05 level? Calculate z value and comment on the null hypotheses.

Dua pekali korelasi yang diperolehi dari sampel saiz $N_1 = 24$ dan $N_2 = 30$ telah dikira sebagai $r_1 = 0.70$ dan $r_2 = 0.25$, masing-masing. Adakah terdapat perbezaan yang nyata antara dua pekali pada tahap 0.05? Kira nilai z dan ulaskan tentang hipotesis nul.

(8 marks/markah)

- [c] Fit a least-squares parabola of the form $Y = a_0 + a_1 X + a_2 X^2$ to the set of data in Table 4. It is given that the value of $N=10$.

Padankan kuasa dua terkecil parabola di dalam bentuk $Y = a_0 + a_1 X + a_2 X^2$ untuk set data di dalam Jadual 4. Diberikan nilai $N=10$.

Table 4
Jadual 4

X	1.2	1.8	2.5	3.1	4.9	5.7	7.1	8.6	9.8	10.5
Y	4.5	5.9	6.4	7.0	7.8	7.2	6.8	4.5	2.7	2.0

(8 marks/markah)

5. [a] Table 5 [a] gives experimental values of the pressure P of Argon gas corresponding to various values of the volume V . According to the thermodynamic principles, a relationship was derived as

$$PV^\gamma = C$$

where γ and C are constants.

Jadual 5[a] memberikan nilai ujikaji tekanan P gas Argon yang diberikan bersepadan dengan pelbagai nilai-nilai isipadu V . Mengikut prinsip-prinsip termodinamik, suatu hubungan diterbitkan sebagai

$$PV^\gamma = C$$

di mana γ dan C adalah pemalar.

- (i) Find the values of γ and C . Write an equation relating P and V .
Carikan nilai-nilai untuk γ dan C . Tuliskan persamaan menghubungkan P dan V .
- (ii) Estimate V when $P = 95$ Pa.
Anggarkan V apabila $P = 95$ Pa.

(8 marks/markah)

Table 5 [a]
Jadual 5 [a]

Volume V (cm^3)	55.5	65.5	75.5	85.5	95.5	105.5
Pressure P (Pa)	61.2	49.2	37.6	28.4	19.2	10.1

- [b] Based on the data in Table 5[b], determine the coefficient of linear correlation using coding method as shown in Equation 1.**

Berdasarkan data di dalam Jadual 5[b], carikan pemalar linear korelasi menggunakan kaedah kod seperti dalam Persamaan 1.

$$r = \frac{N \sum f_{XY} - (\sum f_x X)(\sum f_y Y)}{\sqrt{[N \sum f_x X X - (\sum f_x X)^2] [N \sum f_y Y Y - (\sum f_y Y)^2]}} \quad \text{Eq. 1}$$

(6 marks/markah)

- [c] From Table 5[b], use the data to calculate standard error of estimate of x , (i) s_X , (ii) s_Y and (iii) s_{XY} , thus to verify the formula.**

$$r = s_{XY} / s_X s_Y$$

Daripada Jadual 5[b], gunakan data untuk mengira piawai ralat tafsiran bagi x (i) s_X , (ii) s_Y dan (iii) s_{XY} seterusnya sahkan formula.

$$r = s_{XY} / s_X s_Y$$

Table 5 [b]
Jadual 5 [b]

		Volume range (cm ³)						Total
		40-49	50-59	60-69	70-79	80-89	90-99	
Pressure range (Pa)	90-99				2	4	4	10
	80-89			1	4	6	5	16
	70-79			5	10	8	1	24
	60-69	1	4	9	5	2		21
	50-59	3	6	6	2			17
	40-49	3	5	4				12
	Total	7	15	25	23	20	10	100

(6 marks/markah)

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