UNIVERSITI MALAYSIA PERLIS

Peperiksaan Akhir Semester Pertama
Sidang Akademik 2025/2026

Februari 2026

IMC11503 – Discrete Mathematics
[*Matematik Diskret*]

Masa : 2 jam

Please make sure that this question paper has **EIGHT (8)** printed pages, including this front page, before you start the examination.
*[Sila pastikan kertas soalan ini mengandungi **LAPAN (8)** muka surat yang bercetak termasuk muka hadapan sebelum anda memulakan peperiksaan ini.]*

This question paper has **FOUR (4)** questions. Answer **ALL** questions. Each question contributes 15 marks.
*[Kertas soalan ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan. Markah bagi setiap soalan adalah 15 markah.]*

Dicetak oleh Unit Peperiksaan & Pengijazahan, Bahagian Pengurusan Akademik, Pusat Pengurusan Akademik UniMAP

(CO1, PO1, C4)
Question 1
[Soalan 1]

(a) By using a truth table to verify $A(B+C)=AB+AC$ for all possible input combinations of A, B and C.
[Dengan menggunakan jadual kebenaran untuk mengesahkan semua kemungkinan kombinasi input A, B dan C.]

(5 Marks/ *Markah*)

(b) Consider a security system with three sensors: a motion sensor (M), a door sensor (D), and a window sensor (W). The system is designed to active if either one of these conditions is met:
[Pertimbangkan system keselamatan dengan tiga penderia: penderia gerakan (M), penderia pintu (D), dan penderia tingkap (W). Sistem ini direka bentuk untuk aktif jika salah satu daripada syarat ini dipenuhi:]

I.	Motion is detected, a door is opened, but no window is opened. *[Pergerakan dikesan, pintu dibuka, tetapi tiada tingkap dibuka.]*
II.	No motion is detected, a door is opened and a window is opened. *[Tiada Gerakan dikesan, pintu dibuka dan tingkap dibuka.]*

(i) Analyse the system and write a Boolean expression to represent the conditions when the alarm system is activated.
[Analisis sistem tersebut dan tulis ungkapan Boolean untuk mewakili keadaan di mana sistem penggera akan diaktifkan.]

(2 Marks/ *Markah*)

(ii) Construct a truth table for the system using the result of Question 1(b)(i).
[Bina satu jadual kebenaran bagi sistem tersebut menggunakan hasil daripada Soalan 1(b)(i).]

(4 Marks/ *Markah*)

(iii) Design a logic circuit to implement the given conditions.
[Reka litar logik untuk melaksanakan syarat yang diberikan.]

(4 Marks/ *Markah*)

(CO1, PO1, C3)
Question 2
[Soalan 2]

(a) By using division by primes, find the greatest common divisor (GCD) of 105 and 210.
[Menggunakan pembahagian nombor prima, dapatkan pembahagi umum terbesar (GCD) bagi 105 dan 210.]

(4 Marks/ *Markah*)

(b) Solve the following function:
[Selesaikan fungi berikut:]

(i) $28 \pmod 3$

(2 Marks/ *Markah*)

(ii) $82 \equiv 33 \pmod{11}$

(3 Marks/ *Markah*)

(c) Given the following words,
[Diberi perkataan berikut,]

$$p = 1001$$
$$q = 1101.$$

(i) Calculate the weight of p and q.
[Kirakan pemberat p dan q.]

(3 Marks/ *Markah*)

(ii) Write a word code for p and q using parity check code.
[Tuliskan kod perkataan bagi p dan q menggunakan kod semakan pariti.]

(3 Marks/ *Markah*)

(CO2, PO2, C3)
Question 3
[Soalan 3]

(a) A website has three user groups: purchasers (P), subscribers (S) and social media engagers (E). Total of 100 users made a purchase, 75 subcribed to the newsletter and 73 engaged with social media posts. Additionally, 30 users made purchases and subscribed, 25 made purchases and engaged with social media, 18 subscribed and engaged with social media, and some did neither.
[Sebuah laman sesawang mempunyai tiga kumpulan pengguna: pembeli (P), pelanggan (S) dan pengiat media sosial (E). Sejumlah 100 pengguna membuat pembelian, 75 melanggan surat berita dan 73 terlibat dengan siaran media sosial. Selain itu, 30 pengguna membuat pembelian dan melanggan, 25 membuat pembelian dan terlibat dengan media sosial, 18 melanggan dan terlibat dengan media sosial, dan sebahagian tidak melakukannya.]

Based on this situation, answer the following questions:
[Berdasarkan situasi ini, jawab soalan-soalan berikut:]

(i) If $n(P \cup S \cup E) = 180$, find the total number of users who did all three.
[Jika $n(P \cup S \cup E) = 180$, dapatkan jumlah bilangan pengguna yang melakukan ketiga-tiganya.]
(3 Marks/ *Markah*)

(ii) Draw a Venn diagram to illustrate the relationships among the three sets.
[Lukiskan satu rajah Venn untuk mengambarkan hubungan antara tiga set tersebut.]
(3 Marks/ *Markah*)

(iii) Find the total number of users who only subscribed to the newsletter.
[Dapatkan jumlah bilangan pengguna yang hanya melanggan surat berita.]
(2 Marks/ *Markah*)

(iv) Find the total number of users who don't belong to any group.
[Dapatkan jumlah bilangan pengguna yang tidak tergolong dalam mana-mana kumpulan.]
(2 Marks/ *Markah*)

(b) By using permutation dan combination, solve the following equation:
[Dengan menggunakan permutasi dan gabungan selesaikan persamaan berikut:]

(i) $P(8,5)$
(3 Marks/ *Markah*)

(ii) $C(14,2)$
(2 Marks/ *Markah*)

(CO2, PO2, C4)
Question 4
[Soalan 4]

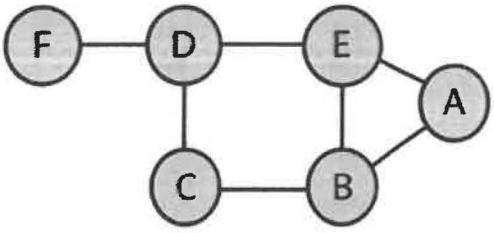

Figure 4.1
[Rajah 4.1]

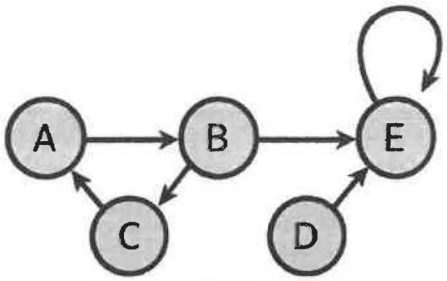

Figure 4.2
[Rajah 4.2]

(a) **Figure 4.1** and **Figure 4.2** show two diagrams illustrating the roads in Town A.
***[Rajah 4.1** dan **Rajah 4.2** menunjukkan dua gambar rajah yang menggambarkan jalan di Bandar A.]*

(i) Identify the type of graph whether it is a directed graph or undirected graph for each figure and justify your answer.
[Kenal pasti jenis graf sama ada graf berarah atau graf tidak berarah bagi setiap rajah dan berikan justifikasi bagi jawapan anda.]

(4 Marks/ *Markah*)

(ii) State the number of vertices $|V|$ and number of edges for each figure.
[Nyatakan bilangan bucu $|V|$ dan jumlah bilangan tepi bagi setiap rajah.]

(4 Marks/ *Markah*)

(b) **Table 4.1** shows the depth and vertices of rooted tree. Analyse the table below and answer the following questions.
*[**Jadual 4.1** menunjukkan kedalaman dan bucu bagi pohon berakar. Analisis jadual di bawah dan jawab soalan-soalan berikut.]*

Table 4.1
[Jadual 4.1]

Depth *[Kedalaman]*	0	1	2	3	4	5
Vertices *[Bucu]*	6	3	1	2	4	7
		9			5	8

(i) Sketch the rooted tree.
[Lakarkan pohon berakar.]

(3 Marks/ *Markah*)

(ii) List the vertices of leaves or end-nodes.
[Tentukan bucu-bucu daun atau nod-hujung.]

(2 Marks/ *Markah*)

(iii) Find the path that connects the root with **node 5** and determine the path length.
*[Dapatkan laluan yang menghubungkan akar dengan **nod 5** dan tentukan panjang laluan tersebut.]*

(2 Marks/ *Markah*)

APPENDIX A
[LAMPIRAN A]

Parity Check Code If $b = b_1 b_2 \ldots b_m \in B^m$, define $f(b) = b_1 b_2 \ldots b_m b_{m+1}$ where $b_{m+1} = \begin{cases} 0 \text{ if } \lvert b \rvert \text{is even} \\ 1 \text{ if } \lvert b \rvert \text{is odd} \end{cases}$
Permutation $P(n,r) = \frac{n!}{(n-r)!}$
Combination $C(n,r) = \frac{n!}{r!(n-r)!}$

APPENDIX B
[LAMPIRAN B]

CO – PO Information
[Maklumat CO – PO]

CO

CO1	Ability to apply discrete mathematical concepts for data science problem-solving.
CO2	Ability to analyze discrete mathematical concepts and their applications in data science.

PO

PO1	Knowledge & Understanding – Analyse data, concepts, principles and theories relating to Data Science.
PO2	Cognitive Skills – Apply appropriate concepts and methods for optimised Data Science solutions.

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