(6)

SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI JUN 2017

DBM3013 : ENGINEERING MATHEMATICS 3

TARIKH : 29 OKTOBER 2017
MASA : 2.30 PETANG - 4.30 PETANG (2 JAM)

Kertas ini mengandungi **LIMA BELAS (15)** halaman bercetak.
Bahagian A: Struktur (4 soalan)
Bahagian B: Struktur (2 soalan)
Dokumen sokongan yang disertakan : Kertas Graf & Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 75 MARKS

BAHAGIAN A : 75 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **THREE (3)** questions only.

ARAHAN :

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **TIGA (3)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO2
C2

(a) The data below shows weight of 50 students.

Data di bawah menunjukkan berat 50 orang pelajar.

45	64	64	69	53	51	64	65	49	67
58	61	50	46	53	54	47	50	53	68
54	52	47	57	61	50	66	48	65	63
48	61	51	56	54	69	64	51	59	53
57	61	59	56	54	68	65	55	59	55

i. Construct a Frequency Distribution Table for the data above by using size class of 4.

Binakan Jadual Taburan Kekerapan bagi data di atas menggunakan saiz kelas 4.

[5 marks]

[*5 markah*]

ii. From the Frequency Table above, draw a histogram.
Daripada Jadual Kekerapan di atas, lukiskan histogram.

[5 marks]
[*5 markah*]

CLO2
C3

(b)

i. Based on the given data, calculate:
Berdasarkan data yang diberi, kirakan:

6 7 3 4 7 7 8 8 9

a. Mean.
Min.

[3 marks]
[*3 markah*]

b. Mode.
Mod.

[1 mark]
[*1 markah*]

c. Median.
Median.

[2 marks]
[*2 markah*]

ii. The recorded data in **Table 1(b)** is the number of residents living in each unit of an apartment. Give your answer to 4 decimal places.

*Data yang direkodkan dalam **Jadual 1(b)** adalah bagi sejumlah penduduk yang tinggal dalam setiap unit di pangsapuri. Berikan jawapan anda sehingga 4 titik perpuluhan.*

Class (x) ***Kelas***	2	3	4	5	6	7	8
Frequency (f) ***Kekerapan***	1	4	4	7	4	3	1

Table 1(b) / *Jadual 1(b)*

Calculate:

Kirakan:

a. Mean.

Min.

[3 marks]

[*3 markah*]

b. Mean Deviation.

Sisihan Min.

[3 marks]

[*3 markah*]

c. Variance.

Varians.

[3 marks]

[*3 markah*]

QUESTION 2

SOALAN 2

CLO2
C2

(a) Two coins are tossed simultaneously. Express the probability of obtaining:
Dua syiling yang sama dilambung secara serentak. Nyatakan kebarangkalian mendapat:

i. Two heads.
Dua kepala.

[3 marks]
[*3 markah*]

ii. Two tails.
Dua ekor.

[2 marks]
[*2 markah*]

iii. No tail.
Tiada ekor.

[1 mark]
[*1 markah*]

iv. A head.
Satu kepala.

[2 marks]
[*2 markah*]

v. A head and a tail.
Satu kepala dan satu ekor.

[2 marks]
[*2 markah*]

CLO2
C3

(b)

i. There are three societies in a school. They are English Language Society (E), Malay Language Society (M) and Science Society (S). The information regarding students joining the societies is as follows:

Terdapat tiga persatuan di sebuah sekolah. Persatuan tersebut adalah Persatuan Bahasa Inggeris (E), Persatuan Bahasa Melayu (M) dan Persatuan Sains (S). Maklumat mengenai pelajar yang menyertai persatuan adalah seperti berikut:

$$P(E) = 0.4$$
$$P(E \cup M) = 0.65$$
$$P(E \cup S) = 0.8$$
$$P(E \cap M) = 0.15$$
$$P(E \cap S) = 0.2$$
$$P(M \cap S) = 0.2$$
$$P(E \cup M \cup S) = 0.95$$

A student is selected at random from the school. Calculate the probability that the student is a member of all three societies:

Pelajar dipilih secara rawak daripada sekolah tersebut. Kirakan kebarangkalian pelajar adalah ahli ketiga-tiga persatuan:

[5 marks]
[*5 markah*]

ii. A and B are two events whereby $P(B) = \frac{1}{5}$, $P(B|A) = \frac{1}{3}$ and $P(A|B) = \frac{1}{2}$.

A dan B adalah dua peristiwa di mana $P(B) = \frac{1}{5}$, $P(B|A) = \frac{1}{3}$ *dan* $P(A|B) = \frac{1}{2}$.

a. Determine whether A and B independent events?
Tentukan adakah A dan B peristiwa tidak bersandar?

[2 marks]
[*2 markah*]

b. Determine whether A and B mutually exclusive events?
Tentukan adakah A dan B peristiwa saling eksklusif?

[2 marks]
[*2 markah*]

c. Calculate $P(A \cap B)$.
Kirakan $P(A \cap B)$.

[2 marks]
[*2 markah*]

d. Calculate P $(A \cup B)$.
Kirakan $P(A \cup B)$.

[4 marks]
[*4 markah*]

ii. A store sells two types of fan, A and B. The store's owner pays RM100 for fan A and RM125 for fan B. For each unit of fan A yields a profit of RM10 while each unit of fan B yields a profit of RM20. The store's owner estimates that not more than 200 fans should be sell every month and he does not plan to invest more than RM50,000 in the fan's inventory. List the inequalities that fulfilled the condition above.

Sebuah kedai menjual dua jenis kipas, A dan B. Pemilik kedai membayar RM100 dan RM125 untuk setiap unit kipas A dan B masing-masing. Satu unit kipas A memberi keuntungan sebanyak RM10 manakala satu unit kipas B memberi keuntungan sebanyak RM20. Pemilik kedai menganggarkan bahawa tidak lebih 200 kipas yang boleh dijual setiap bulan dan beliau tidak bercadang untuk melabur lebih RM50,000 bagi inventori kipas ini. Senaraikan ketaksamaan yang memenuhi syarat di atas.

[6 marks]
[*6 markah*]

CLO2
C3

(b) A company produces two types of chairs, C1 and C2. It takes 2 hours to produce the parts of one unit of C1, 1 hour to assemble and 2 hours to polish. It takes 3 hours to produce the parts of one unit of C2, 2.5 hours to assemble and 1.5 hours to polish. Per month, 7,000 hours are available for producing the parts, 4,000 hours for assembling the parts and 5,500 hours for polishing the chairs. The profit per unit of C1 is RM90 and per unit of C2 is RM110.

Sebuah syarikat mengeluarkan dua jenis kerusi, C1 dan C2. Ia mengambil masa 2 jam untuk menghasilkan bahagian-bahagian bagi sebuah kerusi C1, 1 jam untuk dihimpunkan dan 2 jam untuk dikilatkan. Ia mengambil masa 3 jam untuk menghasilkan bahagian-bahagian bagi sebuah kerusi C2, 2.5 jam untuk dihimpunkan dan 1.5 jam untuk dikilatkan. Setiap bulan, 7,000 jam diperlukan untuk menghasilkan bahagian-bahagian, 4,000 jam untuk menghimpunkan bahagian-bahagian dan 5,500 jam untuk mengilatkan kerusi. Keuntungan untuk sebuah kerusi C1 adalah RM90 dan untuk sebuah kerusi C2 adalah RM110.

i. List **THREE (3)** inequalities other than $x \geq 0$ and $y \geq 0$ that satisfy all of the above constraints.

*Senaraikan **TIGA (3)** ketaksamaan selain $x \geq 0$ dan $y \geq 0$ yang memenuhi kekangan di atas.*

[3 marks]
[*3 markah*]

ii. Using a scale of 2 cm to 500 units on axes, draw and shade the feasible region that satisfied all the given constraints.

Menggunakan skala 2 cm kepada 500 unit untuk kedua-dua paksi, lukis dan lorekkan rantau yang memenuhi kekangan yang diberi.

[8 marks]
[*8 markah*]

iii. Based on your graph, how many of each type of chairs should be produced in order to maximize the total of monthly profit?

Berdasarkan graf anda, berapakah bilangan setiap jenis kerusi yang perlu dikeluarkan bagi memaksimumkan jumlah keuntungan bulanan.

[4 marks]

[*4 markah*]

QUESTION 4

SOALAN 4

CLO2 C2

(a) Given Linear Programming problem as below:

Diberi masalah pengaturcaraan linear seperti di bawah:

Maximize $P = 5a + 2b + 8c$, subject to constraints

Maksimumkan $P = 5a + 2b + 8c$, *tertakluk kepada kekangan*

$$2a - 4b + c \leq 42$$
$$2a + 3b - c \leq 27$$
$$6a - b + 3c \leq 12$$
$$a \geq 0, b \geq 0, c \geq 0$$

i. Rewrite the objective function above in standard form.

Tuliskan semula fungsi objektif di atas dalam bentuk piawai.

[2 marks]

[*2 markah*]

ii. Rewrite the corresponding system of constraints equation in a standard form.

Tuliskan semula persamaan kekangan-kekangan yang sepadan dalam bentuk piawai.

[3 marks]

[*3 markah*]

iii. Convert the standard form above into First Initial Tableau Table.
Tukarkan bentuk piawai di atas kepada bentuk Jadual Tableau Permulaan.

[5 marks]
[*5 markah*]

CLO2
C3

(b) Solve the following linear programming by using Simplex method.
Selesaikan Pengaturcaraan Linear berikut dengan menggunakan kaedah Simplex.

Maximize $z = x_1$

Maksimum $z = x_1$

Subject to
Tertakluk kepada

$$3x_1 + 2x_2 \leq 60$$
$$x_1 + 2x_2 \leq 28$$
$$x_1 + 4x_2 \leq 48$$

Where $x_1, x_2 \geq 0$

Di mana $x_1, x_2 \geq 0$

[15 marks]
[*15 markah*]

SECTION B : 25 MARKS

BAHAGIAN B : 25 MARKAH

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ONE (1)** question only.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SATU (1)** soalan sahaja.*

QUESTION 5

SOALAN 5

CLO1
C2

(a)

i. Convert the following equation into AX=B form :

Tukarkan persamaan berikut kepada bentuk $AX = B$:

a. $4y - 6z = 5$

$3x + 6y - 9z = -5$

$-4x = 4$

[2 mark]

[*2 markah*]

b. $2x + 6z + 2 = 0$

$x + 2y + 9z + 5 = 0$

$6y - 6z = 5$

[2 mark]

[*2 markah*]

ii. Identify the real root by using the Newton Raphson method correct to 3 decimal places for $f(x) = x^3 - x - 1$ where $x_0 = \sqrt{2}$.

Kenal pasti punca sebenar dengan menggunakan kaedah Newton Raphson tepat kepada 3 titik perpuluhan bagi $f(x) = x^3 - x - 1$ *dimana* $x_0 = \sqrt{2}$.

[6 marks]

[*6 markah*]

CLO1 C3

(b) Find the value of x_1, x_2 and x_3 by using the Crout Method.

Cari nilai x_1, x_2 *dan* x_3 *dengan menggunakan Kaedah Crout.*

$$2x_1 + x_2 + x_3 = 10$$
$$3x_1 + 2x_2 + 3x_3 = 18$$
$$x_1 + 4x_2 + 9x_3 = 16$$

[15 marks]

[*15 markah*]

QUESTION 6

SOALAN 6

CLO1 C2

(a) Compute the First Order Differential Equation below :

Kirakan Persamaan Pembezaan Pertama dibawah :

i. $xy^2\ dx - x^2y^2\ dy = 0$

[4 marks]

[*4 markah*]

ii. $y' + \frac{x}{y} = 0$

[3 marks]

[*3 markah*]

iii. $\sin x\ dx + y^2\ dy = 0$

[3 marks]

[*3 markah*]

CLO1
C3

(b)

i. Solve $y' = \frac{y+x}{x}$ by using Homogeneous Equation Method

Selesaikan $y' = \frac{y+x}{x}$ *dengan menggunakan kaedah Persaman Homogeneous*

[5 marks]

[*5 markah*]

ii. Solve the Second Order Differential Equation below :

Selesaikan Persamaan Pembezaan Kedua dibawah :

a. $y'' - y' - 2y = 0$

[4 marks]

[*4 markah*]

b. $y'' - 3y' + 4y = 0$

[6 marks]

[*6 markah*]

SOALAN TAMAT

FORMULA DBM3013- ENGINEERING MATHEMATICS 3

DESCRIPTIVE STATISTICS		
Number of class	$k = 1+3.33 \log n$	
Mean	$\bar{x} = \frac{\sum x}{n}$	$\bar{x} = \frac{\sum (fx)}{\sum f}$
Median	Median = $L_m + \left[\frac{\frac{N}{2} - F}{f_m}\right] C$	
Mode	Mode = $L_{Mo} + \left[\frac{d_1}{d_1 + d_2}\right] C$	
Quartile	$Q_k = L_{Q_k} + \left[\frac{\frac{kN}{4} - F}{f_{Q_k}}\right] C$; k = 1, 2, 3	
Decile	$D_k = L_{D_k} + \left[\frac{\frac{kN}{10} - F}{f_{D_k}}\right] C$; k = 1, 2, 3..... 9	
Percentile	$P_k = L_{P_k} + \left[\frac{\frac{kN}{100} - F}{f_{P_k}}\right] C$; k = 1, 2, 3 99	
Mean Deviation	$E = \frac{\sum \lvert x - \bar{x} \rvert}{n}$	$E = \frac{\sum (\lvert x - \bar{x} \rvert f)}{\sum f}$
Variance	$s^2 = \frac{\sum (x - \bar{x})^2}{n}$	$s^2 = \frac{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}{n}$
	$s^2 = \frac{\sum [(x - \bar{x})^2 f]}{\sum f}$	$s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$
Standard Deviation	$s = \sqrt{\text{var}\,iance}$	

NUMERICAL METHOD		
Crout Method	$A=\begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix}\begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$	
Doolittle Method	$A=\begin{pmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{pmatrix}\begin{pmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{pmatrix}$	
Newton Raphson Method	$x_0 = \frac{1}{y_2 - y_1}\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$	$x_{n+1} = x_n - \frac{f(x)}{f'(x)}$

PROBABILITY	
$E = pn$	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$P(B\|A) = \frac{P(B \cap A)}{P(A)}$	$P(A \cap B) = P(A).P(B)$
	$P(A \cap B) = P(A).P(B\|A)$

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION	
Homogeneous Equation $y = vx$ and $\frac{dy}{dx} = v + x\frac{dv}{dx}$	Linear Factors (Integrating Factors) $y \bullet IF = \int Q \bullet IF\, dx$ Where $IF = e^{\int P\, dx}$
	Logarithmic $a = e^{\ln a}$ $a^x = e^{x \ln a}$ $\int a^x\, dx = \frac{a^x}{\ln a} + c$

GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION	
Equation of the form $a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$	
1. Real & different roots:	$y = Ae^{m_1 x} + Be^{m_2 x}$
2. Real & equal roots:	$y = e^{mx}(A + Bx)$
3. Complex roots:	$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0, k \text{ is constant}$	2.	$\frac{d}{dx}(x^n) = nx^{n-1}$ [Power Rule]
3.	$\frac{d}{dx}(ax^n) = anx^{n-1}$	4.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$
5.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ [Product Rule]	6.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ [Quotient Rule]
7.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$ [Chain Rule]	8.	$\frac{d}{dx}(e^x) = e^x$
9.	$\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$	10.	$\frac{d}{dx}(\ln x) = \frac{1}{x}$
11.	$\frac{d}{dx}[\ln(ax+b)] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$	12.	$\frac{d}{dx}(\sin x) = \cos x$
13.	$\frac{d}{dx}(\cos x) = -\sin x$	14.	$\frac{d}{dx}(\tan x) = \sec^2 x$
15.	$\frac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$	16.	$\frac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \frac{d}{dx}(ax+b)$
17.	$\frac{d}{dx}[\tan(ax+b)] = sec^2(ax+b) \times \frac{d}{dx}(ax+b)$	18.	$\frac{d}{dx}[\sin^n u] = n\sin^{n-1} u \times \cos u \times \frac{du}{dx}$
19.	$\frac{d}{dx}[cos^n u] = n\cos^{n-1} u \times -\sin u \times \frac{du}{dx}$	20.	$\frac{d}{dx}[tan^n u] = n\,tan^{n-1} u \times sec^2 u \times \frac{du}{dx}$

INTEGRATION			
1.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c \;\; ; \{n \neq -1\}$	2.	$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c \; ; \{n \neq -1\}$
3.	$\int k\, dx = kx + c, k \text{ is constant}$	4.	$\int_a^b f(x)dx = F(b) - F(a)$
5.	$\int \frac{1}{x}\, dx = \ln x + c$	6.	$\int \frac{1}{ax+b}\, dx = \frac{1}{a} \times \ln(ax+b) + c$
7.	$\int e^x\, dx = e^x + c$	8.	$\int e^{ax+b}\, dx = \frac{1}{a} \times e^{ax+b} + c$
9.	$\int \sin x\, dx = -\cos x + c$	10.	$\int \cos x\, dx = \sin x + c$
11.	$\int sec^2 x\, dx = \tan x + c$		
12.	$\int \sin(ax+b)\, dx = -\frac{1}{\frac{d}{dx}(ax+b)} \times \cos(ax+b) + c$		
13.	$\int \cos(ax+b)\, dx = \frac{1}{\frac{d}{dx}(ax+b)} \times sin\,(ax+b) + c$		
14.	$\int sec^2(ax+b)\, dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \tan(ax+b) + c$		