

SULIT

UNIVERSITI MALAYSIA PERLIS

Peperiksaan Akhir Semester
Sidang Akademik 2019/2020

Disember 2019 / Januari 2020

EKT224 – Algorithm and Data Structures
[Algoritma dan Struktur-Struktur Data]

Masa : 3 Jam

Please make sure that this question paper has **ELEVEN (11)** printed pages including this front page before you start the examination.

*[Sila pastikan kertas soalan ini mengandungi **SEBELAS (11)** muka surat yang bercetak termasuk muka hadapan sebelum anda memulakan peperiksaan ini.]*

This question paper has **TWO (2)** sections.

*[Kertas soalan ini mengandungi **DUA (2)** bahagian.]*

Section **A** has **FOUR (4)** questions with total marks of 80. Answer **ALL** questions from this section.

*[Bahagian **A** mengandungi **EMPAT (4)** soalan dengan jumlah markah 80. Jawab **SEMUA** soalan dari bahagian ini.]*

Section **B** has **TWO (2)** questions with total marks of 20. Answer **ONLY ONE (1)** question from this section.

*[Bahagian **B** mengandungi **DUA (2)** soalan dengan jumlah markah 20. Jawab **HANYA SATU (1)** soalan daripada bahagian ini.]*

SECTION A
[BAHAGIAN A]**Answer ALL questions from this section.***[Jawab SEMUA soalan daripada seksyen ini.]***Question 1***[Soalan 1]***(C2, CO1, PO2)**

(a) Explain the worst case and best case complexity by providing ONE (1) example of time complexity of different sorting algorithm that you know for each case.

[Terangkan kerumitan kes terburuk dan kes terbaik dengan menyediakan SATU (1) contoh kerumitan masa bagi algoritma isihan berbeza yang anda tahu bagi setiap kes.]

(4 Marks/ Markah)

(C4, CO1, PO2)

(b) Obtain the tightest bound possible by giving the big-O notation for each of the following functions $f(n)$. Please justify your answer.

[Dapatkan ikatan yang paling ketat yang mungkin dengan memberikan notasi big-O untuk setiap fungsi $f(n)$ berikut. Hujahkan jawapan anda.]

(i) $f(n) = n^3 * (4\log n - \log n) + (n^2)^2$

(ii) $f(n) = (n * (100n + 5 + n^3))^2$

(iii) $f(n) = n^{1/2} + \log n$

(iv) $f(n) = n^3 * n^2 + (n + 2n)^2$

(8 Marks/Markah)

....3/-

- (c) Given a recursive function in Figure 1. Trace the output for the following function call:

[Diberikan fungsi rekursif di dalam Rajah 1. Surih output bagi panggilan fungsi yang berikut:]

```

int recursive(int a, int b)
{
    if (a%b == 0)
        return b;
    else
        return recursive(b, a%b);
}

```

Figure 1
[Rajah 1]

- (i) recursive(17,3)
(ii) recursive(3,9)

(3 Marks/ Markah)

(C4, CO2, PO2)

- (d) Suppose that there are two matrices $A[3][5]$ and $B[5][3]$ as in Figure 2(a) and Figure 2(b). Get the compact representation of the multiplied matrices, $C[3][3]$.

[Andaikan terdapat dua matrik iaitu $A[3][5]$ dan $B[5][3]$ seperti di dalam Rajah 2(a) dan Rajah 2(b). Dapatkan perwakilan padat hasil darab matrik-matrik tersebut, $C[3][3]$.]

$A[1:3,1:5]$

$$\begin{bmatrix} 0 & -1 & 0 & 5 & 0 \\ 1 & 0 & 3 & 0 & 2 \\ 0 & 4 & 0 & 3 & 0 \end{bmatrix}$$

Figure 2(a)
[Rajah 2(a)]

$B[1:5,1:3]$

$$\begin{bmatrix} 0 & 5 & 7 \\ -2 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & -2 & 0 \\ 9 & 0 & 3 \end{bmatrix}$$

Figure 2(b)
[Rajah 2(b)]

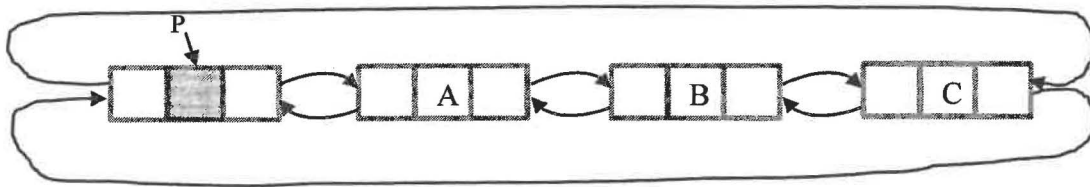
(5 Marks/ Markah)

....4/-

Question 2*[Soalan 2]***(C5, CO2, PO2)**

- (a) A circular doubly linked list P with three elements is logically represented in Figure 3(a). The node structure of a doubly linked list is as in Figure 3(b).

[Satu senarai berpaut berganda bulat P dengan tiga elemen diwakili secara logik di dalam Rajah 3(a). Struktur nod satu senarai berpaut berganda adalah seperti di dalam Rajah 3(b).]

**Figure 3(a)***[Rajah 3(a)]***Figure 3(b)***[Rajah 3(b)]*

- (i) Write a deletion algorithm for the circular doubly linked list P to enable the deletion of node A.

[Tulis algoritma pemadaman untuk senarai berpaut berganda bulat P untuk membolehkan pemadaman nod A.]

(5 Marks/ Markah)

- (ii) Write an insertion algorithm for the circular doubly linked list P to enable the insertion of node D.

[Tulis algoritma kemasukan untuk senarai berpaut berganda bulat P untuk membolehkan kemasukan nod D.]

(5 Marks/ Markah)

....5/-

(C4, CO2, PO2)

(b) Given the following memory snapshot in Figure 4 which stores linked stack L_S and linked queue L_Q. Beginning at the respective addresses, obtain the resulting memory snapshot after the following operations are carried out sequentially.

[Diberikan petikan memori di dalam Rajah 4 yang menyimpan timbunan berpaut L_S dan barisan berpaut L_Q. Bermula dari alamat berkenaan, dapatkan hasil petikan memori selepas operasi-operasi berikut dibuat secara berjujukan.]

	DATA	LINK		
1	ELEANOR AND PARK	7	L_S:	10
2	EMMA	5	AV_SP:	2
3	CARRIE	6	L_Q:	1
4	ANNA KARENINA	9	(FRONT)	
5	ORYX AND CRAKE	4	L_Q:	8
6	DRACULA	0	(REAR)	
7	FRANKENSTEIN	8		
8	OLIVER TWIST	0		
9	ORLANDO	0		
10	SHERLOCK HOLMES	3		

Figure 4
[Rajah 4]

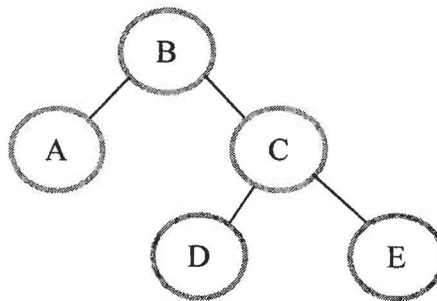
- (i) Enqueue REBECCA into L_Q.
[Enqueue REBECCA ke dalam L_Q.]
- (ii) Pop from L_S.
[Pop dari L_S.]
- (iii) Dequeue from L_Q.
[Dequeue dari L_Q.]
- (iv) Push JANE_EYRE into L_S.
[Push JANE_EYRE ke dalam L_S.]

(10 Marks/ Markah)

....6/-

Question 3*[Soalan 3]***(C4, CO2, PO2)**

- (a) Obtain an array representation of the binary tree in Figure 5.

[Dapatkan perwakilan tatasusunan untuk pohon penduaan yang di dalam Rajah 5.]**Figure 5***[Rajah 5]*

(2 Marks/ Markah)

- (b) The prefix and postfix of a binary tree B are as follows:

[Prefix dan postfix untuk satu pohon penduaan B adalah seperti berikut:]

Prefix : / * + A B - CD + EF

Postfix : AB + CD - * EF +/

Construct the binary tree B.

[Bina pohon penduaan B.]

(10 Marks/ Markah)

....7/-

(c) Obtain the inorder traversal for the tree in Figure 6.
[Dapatkan inorder traversal untuk pohon di dalam Rajah 6.]

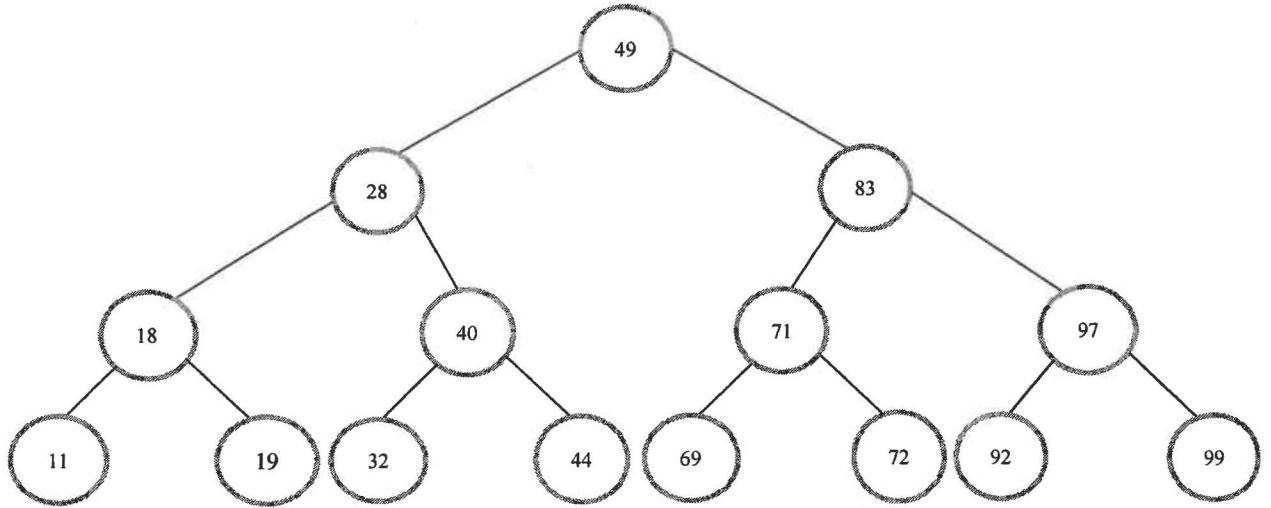


Figure 6
[Rajah 6]

(8 Marks/ Markah)

...8/-

Question 4**[Soalan 4]**

Consider a set of keys in set S. The hash function is $h(X) = X \bmod 9$ and assume that each bucket has three (3) slot.

[Pertimbangkan satu set kekunci di dalam set S. Fungsi cincangan adalah $h(X) = X \bmod 9$ dan andaikan setiap takungan mempunyai tiga (3) slot.]

$$S = \{17, 9, 34, 56, 11, 4, 71, 86, 55, 10, 39, 49, 52, 82, 31, 13, 22, 35, 44, 20, 60, 28\}$$

(C6, CO3, PO2)

- (a) Construct a hash table $H[0:2, 0:8]$ using linear open addressing method to insert the keys in set S.

[Bina jadual cincangan $H[0:2, 0:8]$ menggunakan kaedah alamat lurus terbuka untuk menyelit kekunci ke dalam set S.]

[10 Marks/ Markah]

(C4, CO3, PO2)

- (b) Trace and construct a chained hash table in (a)

[Jejak dan bina rantaian jadual cincangan dalam (a).]

[5 Marks/ Markah]

(C5, CO3, PO2)

- (c) Write the procedure to search for a key in a chained hash table

[Tulis prosedur untuk carian kunci dalam rantaian jadual cincangan.]

[5 Marks/ Markah]

....9/-

SECTION B*[BAHAGIAN B]*

Answer ONLY ONE (1) question from this section.

[Jawab hanya satu (1) soalan daripada seksyen ini.]

Question 5

[Soalan 5]

(a) Consider an ordered list below.

[Pertimbangkan senarai nombor mengikut urutan di bawah.]

10, 13, 2, 16, 32, 44, 23, 14, 43, 50, 34, 33, 1, 5, 100

(C5, CO3, PO2)

(i) Construct the trace of Transpose Sequential Search Algorithm to search a set of key {43, 5}.

[Bina jejak Algoritma Carian Pengubahan Berturutan untuk mencari set kunci {25, 87}.]

(6 Marks/Markah)

(C4, CO3, PO2)

(ii) Analyze the worst and the average time complexity of Transpose Sequential Search Algorithm.

[Analisa kerumitan masa terburuk dan purata bagi Algoritma Carian Pengubahan Berturutan.]

(4 Marks/Markah)

(b) Let $L = \{10, 13, 2, 16, 32, 44, 23, 14, 43, 50, 34, 33, 1, 5, 100\}$ be an unordered list of elements.

[$L = \{10, 13, 2, 16, 32, 44, 23, 14, 43, 50, 34, 33, 1, 5, 100\}$ adalah senarai elemen yang tidak teratur.]

(C5, CO3, PO2)

(i) Construct the trace of Selection Sort to rearrange the numbers into ascending order.

[Bina jejak Isihan Pilihan untuk menyusun nombor-nombor berkenaan ke dalam bentuk susunan menaik.]

(6 Marks/Markah)

(C4, CO3, PO2)

(ii) Analyse the best and average time complexity for Selection Sort.

[Analisa kompleksiti terbaik dan masa purata kompleksiti untuk Isihan Pilihan.]

(4 Marks/Markah)

....10/-

Question 6

[Soalan 6]

(a) Consider an unordered list below.

[Pertimbangkan senarai nombor yang tidak mengikut urutan di bawah.]

220 218 223 112 107 126 119 316 124 140

(C5, CO3, PO2)

(i) Construct the trace of Quick Sort Algorithm to rearrange the following numbers into ascending order. Indicate clearly the pivots that you use.

[Bina Algoritma Isihan Cepat bagi menyusun secara menaik senarai nombor-nombor di bawah. Tunjukkan penggunaan pivot yang digunakan.]

(6 Marks/Markah)

(C4, CO3, PO2)

(ii) Analyze the worst and the average time complexity of Transpose Sequential Search algorithm.

[Analisa kerumitan masa terburuk dan purata bagi algoritma Pengubahan berturutan.]

(4 Marks/Markah)

(b) Consider the given sorted Data List as follows. Here the n ($n=20$) the number of elements is such that $F_9 > (n+1)$ and $F_8 + m = (n+1)$, where $m=0$ and $n=20$.*[Pertimbangkan Senarai Data terisih dan Senarai Carian yang diberikan. Nilai n ($n=20$), nombor elemen adalah $F_9 > (n+1)$ dan $F_8 + m = (n+1)$ di mana, $m=0$ dan $n=20$.]*

Data List: { 2, 4, 8, 9, 17, 36, 44, 55, 81, 94, 116, 221, 256, 302, 356, 396, 401, 434, 536 }

Search List: { 434, 66 }

(C5, CO3, PO2)(i) Design algorithm when the *Fibonacci Search* is undertaken on the keys belonging to the search list.*[Reka bentuk algoritma apabila Carian 'Fibonacci' dilakukan ke atas kekunci yang dimiliki oleh senarai carian.]*

[6 Marks/ Markah]

(C4, CO3, PO2)

(ii) Illustrate the algorithm in b(i) by using the given Data List and Search List.

[Gambarkan algoritma di dalam b(i) dengan menggunakan Senarai Data dan Senarai Carian yang diberikan.]

[4 Marks/ Markah]

APPENDIX*[Lampiran]*a) Course Outcome *[Hasil Pembelajaran]*

No.	Course Outcome, CO
CO1	Ability to analyze the performance of computer programs in terms of space and time complexity.
CO2	Ability to appropriately apply various abstract data types in computer programs.
CO3	Ability to apply and formulate algorithms to solve computational problems.

b) Programme Outcome *[Hasil Program]*

No.	Programme Outcome, PO
PO1	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to the solution of complex engineering problems.
PO2	Identify, formulate, conduct research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4).

-0000000-