SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN TEKNOLOGI MAKLUMAT DAN KOMUNIKASI

PEPERIKSAAN AKHIR

SESI I : 2024/2025

**DFC30233 : DATA STRUCTURES**

**TARIKH : 4 DISEMBER 2024**
**MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)**

---

Kertas ini mengandungi **DUA PULUH LAPAN (28)** halaman bercetak.
Bahagian A: Objektif (30 soalan)
Bahagian B: Struktur (2 soalan)
Dokumen sokongan yang disertakan : Tiada

---

**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SECTION A : 45 MARKS**
***BAHAGIAN A : 45 MARKAH***

**INSTRUCTION:**
This section consists of **THIRTY (30)** objective questions. Mark your answers in the OMR form provided.

***ARAHAN:***
*Bahagian ini mengandungi **TIGA PULUH (30)** soalan objektif. Tandakan jawapan anda di dalam borang OMR yang disediakan.*

CLO1

1. Identify the characteristics of dynamic data structure.
*Kenal pasti ciri-ciri bagi struktur data dinamik.*

   A. Waste extra memory.
   *Pembaziran memori tambahan.*

   B. Size is not fixed.
   *Saiz tidak tetap.*

   C. Store a group of value.
   *Menyimpan sekumpulan nilai.*

   D. Collection of information.
   *Pengumpulan maklumat.*

CLO1

2. Based on Figure A2, select the **CORRECT** index that refers to the value 3.15
*Berdasarkan Rajah A2, pilih index **BETUL** yang merujuk kepada nilai 3.15.*

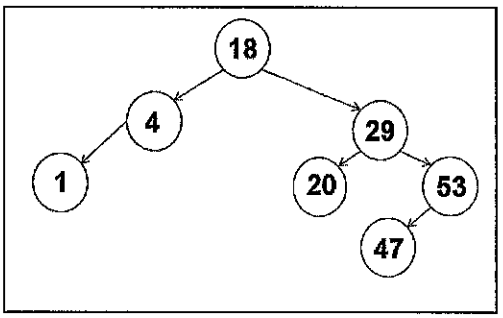
```
float discount[6] = {1.2, 2.17, 3.05, 3.15, 3.44, 3.99};
```

Figure A2 / *Rajah A2*

   A. discount[0];
   B. discount[3];
   C. discount[4];
   D. discount[3.15];

CLO1 3. Identify the **CORRECT** example of a linear data structure.
*Kenal pasti contoh yang **BETUL** bagi struktur data linear.*

A.



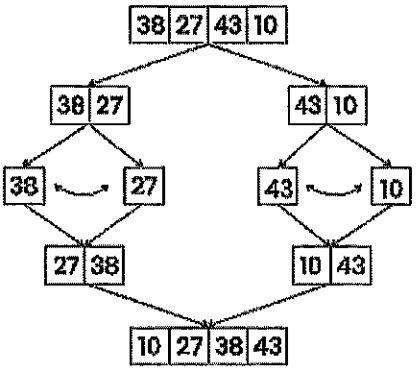

B.

```
struct product
{
 int weight;
 float price;
} apple, banana, melon;
```

C.

| | |
|---|---|
| [3] | |
| [2] | "Durian" |
| [1] | "Banana" |
| [0] | "Mango" |

D.



CLO1 4. Identify the advantage of a linked list over an array.
*Kenal pasti kelebihan senarai berpaut berbanding tatasusunan.*

A. Linked lists are easier to sort than arrays.
*Senarai berpaut lebih mudah diisih daripada tatasusunan.*

B. Linked lists have better cache performance.
*Senarai berpaut mempunyai prestasi cache yang lebih baik.*

C. Linked lists allow dynamic memory allocation.
*Senarai berpaut membenarkan peruntukan memori dinamik.*

D. Linked lists allow efficient random access to elements.
*Senarai berpaut membolehkan capaian rawak yang cekap kepada elemen.*

CLO1 5. Identify the first step in creating a linked list.
*Kenal pasti langkah pertama dalam mencipta senarai berpaut.*

A. Delete the nodes.
*Padam nod.*

B. Traversing the list.
*Merentasi senarai.*

C. Insert data into an array.
*Masukkan data ke dalam tatasusunan.*

D. Initializing the head pointer to NULL.
*Memulakan penuding kepala kepada NULL.*

CLO1 6. Select the benefit of using a linked list in solving problems.
*Pilih kelebihan menggunakan senarai berpaut dalam menyelesaikan masalah.*

A. Sorting a large dataset.
*Mengisih set data yang besar.*

B. Accessing elements based on an index.
*Mengakses elemen berdasarkan indeks.*

C. Searching for an element in a sorted list.
*Mencari elemen dalam senarai disisih.*

D. Repeatedly adding and removing elements at both ends of the list.
*Menambah dan mengalih keluar elemen berulang kali pada kedua-dua hujung senarai.*

CLO1

7. Choose the **CORRECT** figure to store items based on Figure A7.
*Pilih rajah yang **BETUL** untuk menyimpan item berdasarkan Rajah A7.*

Harmoni bundle stores items in a container sequentially with 6 compartments. Each square is located in an index number. The first, second, third and last in the compartment are shoes, t-shirts, shirts and trousers.

*Harmoni bundle menyimpan barang-barang di dalam bekas secara berturutan dengan 6 petak. Setiap petak terletak dalam nombor index. Petak pertama, kedua, ketiga dan yang terakhir dalam petak adalah kasut, t-shirt, kemeja dan seluar.*

Figure A7 / *Rajah A7*

A.

| shoes | t-shirts | shirts | jeans | | |
|---|---|---|---|---|---|
| [0] | [1] | [2] | [3] | [4] | [5] |

B.

| shoes | t-shirts | shirts | jeans | | |
|---|---|---|---|---|---|
| [1] | [2] | [3] | [4] | [5] | [6] |

C.

| | | shoes | t-shirts | shirts | jeans |
|---|---|---|---|---|---|
| [0] | [1] | [2] | [3] | [4] | [5] |

D.

| shoes | t-shirts | shirts | | | jeans |
|---|---|---|---|---|---|
| [0] | [1] | [2] | [3] | [4] | [5] |

CLO1 8. Choose the **CORRECT** answer if node "**are**" has been added as the last node in Figure A8.
*Pilih jawapan yang **BETUL** jika nod "**are**" telah ditambah pada nod terakhir dalam Rajah A8.*

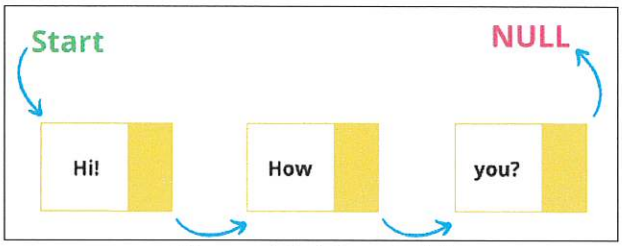
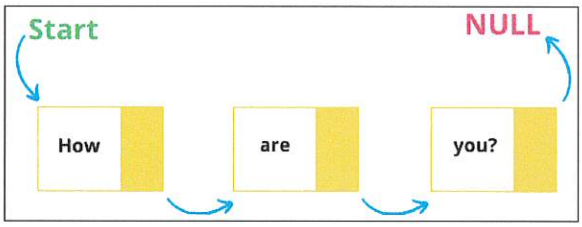
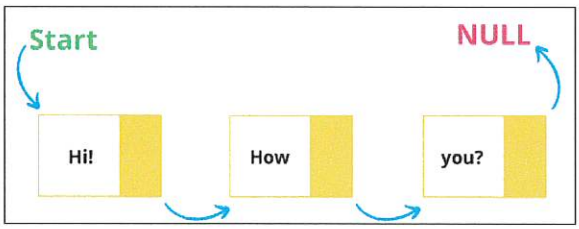



Figure A8 / *Rajah A8*

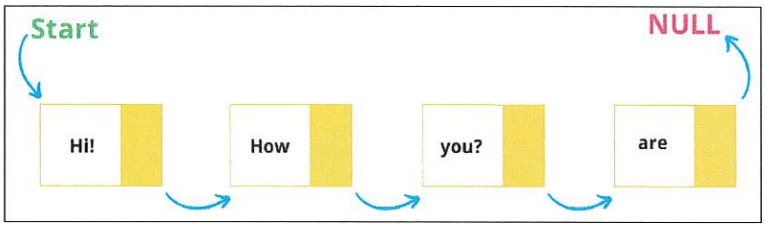
A.



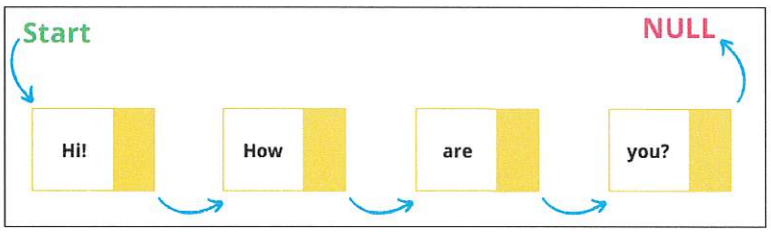

B.




C.




D.



CLO1 9. Identify the operation needed to add new item into stack.
*Kenal pasti operasi yang diperlukan untuk menambah item baru ke dalam tindanan.*

A. Pop
B. Push
C. Add
D. Delete

CLO1 10. Select the item to be removed first in a stack operation.
*Pilih item yang akan dikeluarkan dahulu dalam operasi tindanan.*

A. The oldest item.
*Item tertua.*

B. The middle item.
*Item tengah.*

C. The last item added.
*Item terakhir yang ditambah.*

D. The first item added.
*Item pertama yang ditambah.*

CLO1 11. Select the **CORRECT** stack situation in a restaurant kitchen where orders are placed in a stack to be prepared by the chef.
*Pilih situasi tindanan yang **BETUL** di dapur restoran di mana pesanan diletakkan dalam tindanan untuk disediakan oleh tukang masak.*

A. The chef prepares orders based on the complexity of each dish.
*Chef menyediakan pesanan berdasarkan kerumitan setiap hidangan.*

B. The chef prepares orders randomly, depending on availability of ingredients.
*Chef menyediakan pesanan secara rawak, bergantung pada ketersediaan bahan.*

C. The chef always prepares the earliest orders first, even if newer orders have arrived.
*Chef sentiasa menyediakan pesanan yang terawal terlebih dahulu, walaupun pesanan baru telah tiba.*

D. The chef prepares the most recently placed order first, handling the stack from the top.
*Chef menyediakan pesanan yang paling baru dibuat dahulu, mengurus timbunan dari bahagian atas.*

CLO1

12. Determine the stack for Figure A12 after performing the following operations.
*Tentukan tindanan untuk Rajah A12 setelah operasi berikut dilaksanakan.*

```
i.   Push("Nasi kerabu");
ii.  Push ("Nasi dagang");
iii. Pop();
iv.  Push("Laksam");
v.   Push("Akok");
vi.  Push("Sup belut");
```

Figure A12 / *Rajah A12*

A.

| | |
|---|---|
| [3] | *Sup belut* |
| [2] | *Akok* |
| [1] | *Laksam* |
| [0] | *Nasi kerabu* |

B.

| | |
|---|---|
| [3] | *Nasi kerabu* |
| [2] | *Laksam* |
| [1] | *Akok* |
| [0] | *Sup belut* |

C.

| | |
|---|---|
| [3] | *Akok* |
| [2] | *Laksam* |
| [1] | *Nasi dagang* |
| [0] | *Nasi kerabu* |

*Stack overflow.*
*The stack has reached the maximum size.*

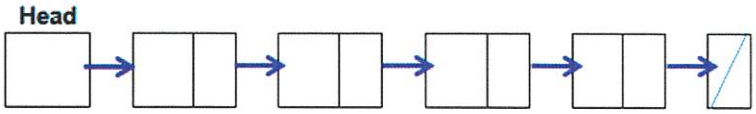
D.

| | |
|---|---|
| [3] | *Sup belut* |
| [2] | *Akok* |
| [1] | *Laksam* |
| [0] | *Nasi kerabu* |

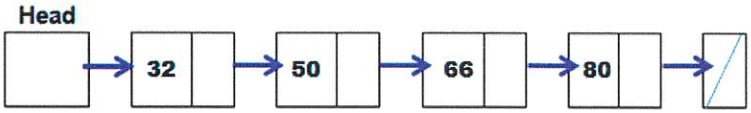
*Stack overflow.*
*The stack has reached the maximum size.*

CLO1 C2 | 13. Determine the stack structure using a linked list after sequentially inserting elements 32, 50, 66, and 80.
*Tentukan struktur tindanan menggunakan senarai berpaut selepas memasukkan elemen 32, 50, 66, dan 80 secara berturutan.*

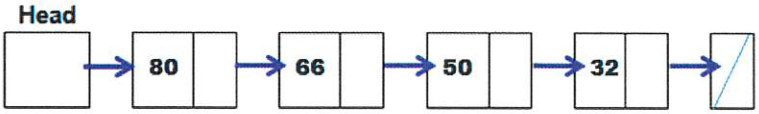
A.



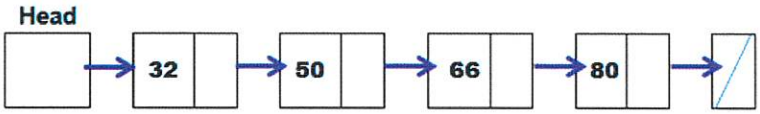

B.




C.




D.




CLO1 | 14. Select an example of a queue in a computer.
*Pilih contoh baris gilir dalam komputer.*

A. Saving files on a hard drive.
*Menyimpan fail pada cakera keras.*

B. Use "Ctrl + Z" to undo text.
*Gunakan "Ctrl + Z" untuk kembali ke teks asal.*

C. Send documents to a printer.
*Hantar dokumen ke pencetak.*

D. Sort a list of names alphabetically.
*Menyisih senarai nama mengikut abjad.*

CLO1 15. Identify the purpose of the dequeue operation in a queue.
*Kenal pasti tujuan operasi 'dequeue' dalam baris gilir.*

A. To check if the queue is full.
*Untuk menyemak sama ada baris gilir penuh.*

B. To add an element to the front of the queue.
*Untuk menambah elemen di hadapan baris gilir.*

C. To remove an element from the rear of the queue.
*Untuk mengalih keluar elemen dari belakang baris gilir.*

D. To remove an element from the front of the queue.
*Untuk mengalih keluar elemen dari hadapan baris gilir.*

CLO1 16. Identify the value of **front**, **rear** and **count** by referring to Figure A16.
*Kenal pasti nilai **front**, **rear** dan **count** dengan merujuk Rajah A16.*

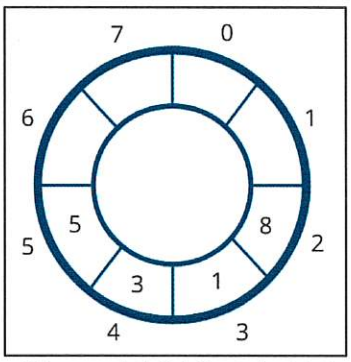


Figure A16 / *Rajah A16*

A. front=0, rear=0, count=0

B. front=2, rear=6, count=4

C. front=2, rear=5, count=5

D. front=0, rear=7, count=5

CLO1 17. Choose the **CORRECT** answer of queue after the operations below is executed.
*Pilih jawapan yang **BETUL** untuk baris gilir selepas operasi di bawah dilaksanakan.*

| | |
|---|---|
| i. | Enqueue ("O", Z); |
| ii. | Enqueue ("B", Z); |
| iii. | Dequeue (Z); |
| iv. | Enqueue ("A", Z); |
| v. | Enqueue ("G", Z); |

Figure A17 / *Rajah A17*

A.

| | B | A | G | Z |
|---|---|---|---|---|
| [0] | [1] | [2] | [4] | |

B.

| B | A | G | | Z |
|---|---|---|---|---|
| [0] | [1] | [2] | [4] | |

C.

| O | B | A | G | Z |
|---|---|---|---|---|
| [0] | [1] | [2] | [4] | |

D.

| B | O | A | G | Z |
|---|---|---|---|---|
| [0] | [1] | [2] | [4] | |

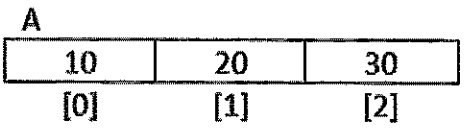
CLO1

18. Determine the output of queue in an array if all operations are executed as follows when the size of array is 3.
*Tentukan keluaran baris gilir dalam tatasusunan jika semua operasi dilaksanakan seperti berikut apabila saiz tatasusunan ialah 3.*

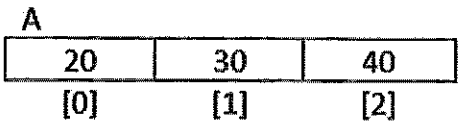
```
 i. Create queue(A);
ii. EnQueue(10, A);
iii. EnQueue(20, A);
iv. EnQueue(30, A);
 v. EnQueue(40, A);
```

Figure A18 / *Rajah A18*

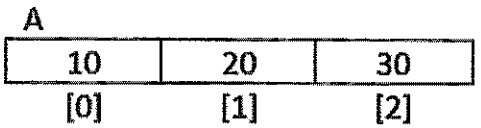
A.




B.

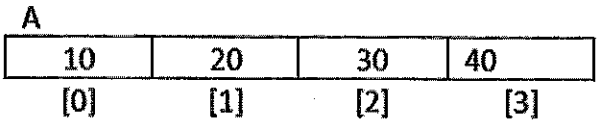



C.




*Queue A is full.*

D.



CLO1

19. Choose the operation that will cause the last output in the queue to **underflow**. Assume that the size of array is 3.
*Pilih operasi yang akan menyebabkan output terakhir dalam baris gilir menjadi **underflow**. Anggapkan bahawa saiz tatasusunan ialah 3.*

A.
```
Create queue(arrayProton);
EnQueue ("Gen-2", arrayProton);
EnQueue ("Iriz", arrayProton);
EnQueue ("Ertiga", arrayProton);
EnQueue ("Savvy", arrayProton);
```

B.
```
Create queue(arrayProton);
EnQueue ("Gen-2", arrayProton);
EnQueue ("Iriz", arrayProton);
DeQueue (arrayProton);
DeQueue (arrayProton);
DeQueue (arrayProton);
```

C.
```
Create queue(arrayProton);
EnQueue ("Gen-2", arrayProton);
EnQueue ("Iriz", arrayProton);
DeQueue (arrayProton);
DeQueue (arrayProton);
```

D.
```
Create queue(arrayProton);
EnQueue ("Gen-2", arrayProton);
EnQueue ("Iriz", arrayProton);
EnQueue ("Ertiga", arrayProton);
DeQueue (arrayProton);
EnQueue ("Savvy", arrayProton);
```

CLO1 20. Identify the **CORRECT** statement about binary tree.
*Kenal pasti pernyataan yang **BETUL** tentang pepohon dedua.*

A. A binary tree is always a balanced tree.
*Pepohon dedua sentiasa merupakan pepohon yang seimbang.*

B. A binary tree is always a complete tree.
*Pepohon dedua sentiasa merupakan pepohon yang lengkap.*

C. In a binary tree, each node has at most two children.
*Dalam pepohon dedua, setiap nod mempunyai paling banyak dua anak.*

D. A binary tree is a tree data structure where each node can have any number of children.
*Pepohon dedua ialah struktur data pepohon di mana setiap nod boleh mempunyai sebarang bilangan anak.*

CLO1 21. Select the **CORRECT** statements when deleting the root node of a Binary Search Tree (BST).
*Pilih pernyataan yang **BETUL** apabila memadamkan nod akar bagi pepohon carian dedua (BST).*

i. The new root will be the in-order successor or in-order predecessor.
*Akar baharu akan menjadi pengganti tertib atau pendahulu tertib.*

ii. The tree might lose its binary search property if deletion is not handled properly.
*Pepohon itu mungkin kehilangan sifat carian deduanya jika penghapusan tidak dikendalikan dengan betul.*

iii. The tree might become unbalanced after the deletion.
*Pepohon mungkin menjadi tidak seimbang selepas penghapusan.*

iv. The root node will be replaced by a leaf node.
*Nod akar akan digantikan dengan nod daun.*

A. i, ii and iii
*i, ii dan iii*

B. i, ii and iv
*i, ii dan iv*

C. i, iii and iv
*i, iii dan iv*

D. ii, iii and iv
*ii, iii dan iv*

CLO1

22. Count the number of nodes in the left subtree of the binary search tree constructed from the following numbers order in Figure A22.
*Kira bilangan nod dalam subpokok kiri bagi pokok carian dedua yang dibina daripada nombor-nombor berikut mengikut susunan dalam Rajah A22.*

**60, 25, 72, 15, 30, 68, 101, 13, 18, 47, 70, 34**

Figure A22 / *Rajah A22*

A. 4

B. 5

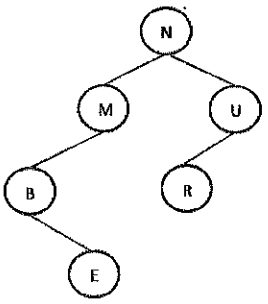
C. 6

D. 7

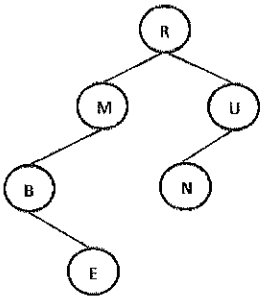
CLO1

23. Determine the **CORRECT** binary search tree structure based on the following sequence of nodes: **[N, U, M, B, E, R]**.
*Tentukan struktur pokok carian binari yang **BETUL** berdasarkan urutan nod berikut: **[N, U, M, B, E, R]**.*

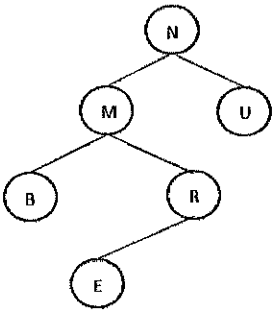
A.



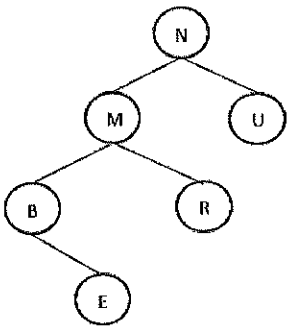

B.




C.




D.



CLO1

24. Choose a new binary search tree for Figure A24 after node 4 is inserted.
*Pilih pepohon carian dedua baharu untuk Rajah A24 selepas nod 4 dimasukkan.*

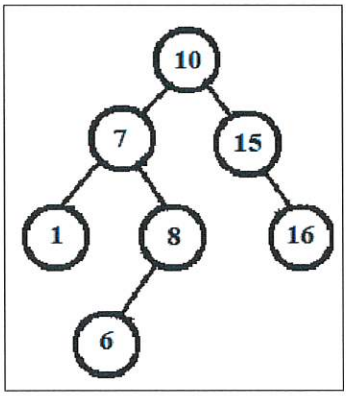
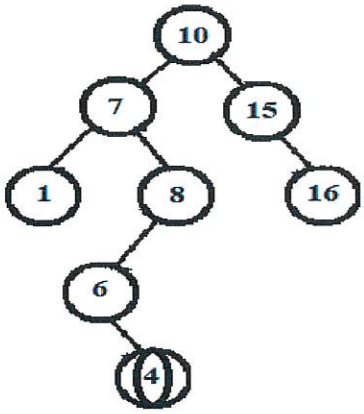
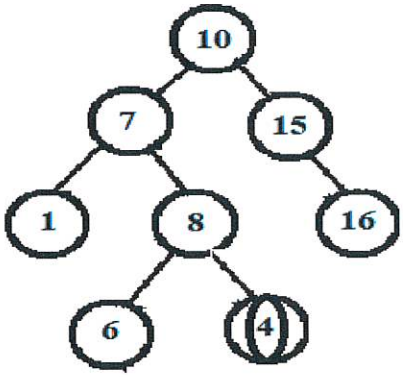



Figure A24 / *Rajah A24*

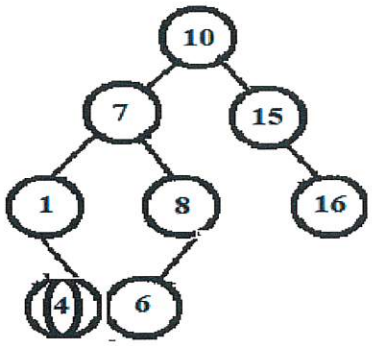
A.



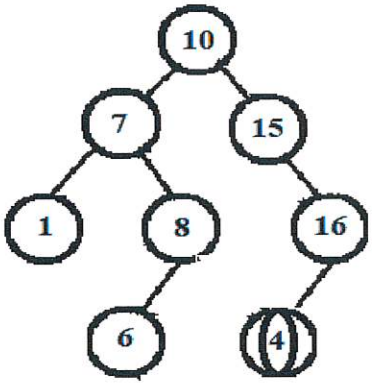

B.



C.




D.



CLO1 25. Find a new binary search tree after node 20 is deleted from Figure A25.
*Cari pepohon carian dedua yang baharu selepas nod 20 dipadamkan dari Rajah A25.*

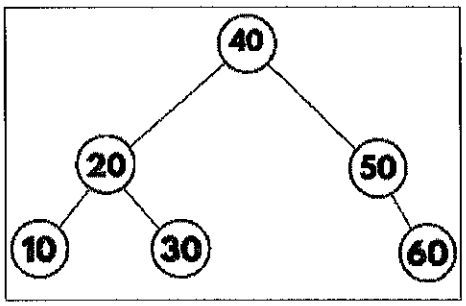
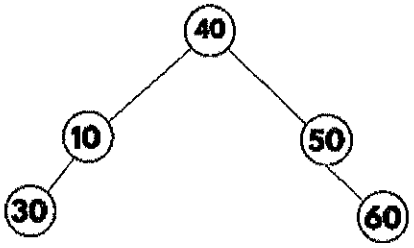
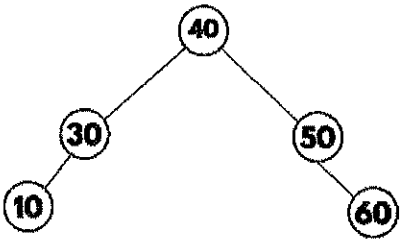



Figure A25 / *Rajah A25*

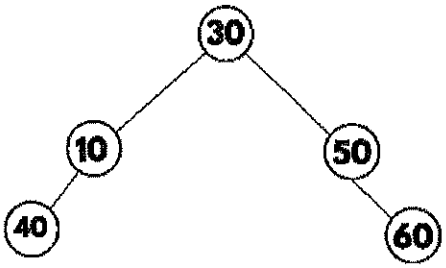
A.



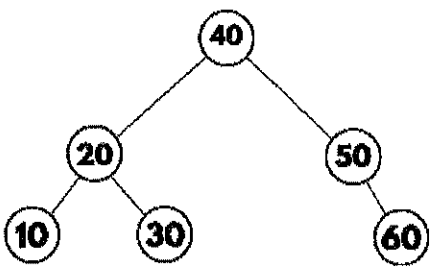

B.




C.




D.




*Cannot delete node 20*

CLO1 26. Determine the **INORDER** for binary search tree as Figure A26.
*Tentukan **INORDER** bagi pepohon carian dedua bagi Rajah A26.*

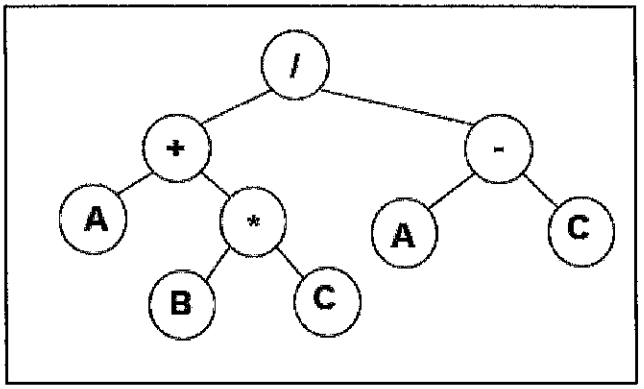



Figure A26 / *Rajah A26*

A. (A + B) */ A – C

B. A + B * C / A – C

C. A + (B * C) (A – C)

D. (A + (B * C)) / (A – C)

CLO1 27. Identify the goal of sorting in data structure.
*Kenal pasti matlamat pengisihan dalam struktur data.*

A. To remove duplicates from the data set.
*Untuk menghapuskan pendua daripada set data.*

B. To encrypt data for secure transmission.
*Untuk menyulitkan data untuk penghantaran selamat.*

C. To convert data into a compressed format for storage.
*Untuk menukar data kepada format termampat untuk penyimpanan.*

D. To organize data in a specific order to make searching and processing more efficient.
*Untuk menyusun data dalam susunan tertentu untuk menjadikan carian dan pemprosesan lebih cekap.*

CLO1

28. Select the answer that represents the third step in sorting the list in ascending order using selection sort.
*Pilih jawapan yang mewakili langkah ketiga dalam menyusun senarai mengikut urutan menaik menggunakan kaedah pilihan isihan.*

| W, H, O, P, I, E |
|---|

A.

| W | H | O | P | I | E |
|---|---|---|---|---|---|

B.

| E | H | O | P | I | W |
|---|---|---|---|---|---|

C.

| E | H | O | I | P | W |
|---|---|---|---|---|---|

D.

| E | H | I | P | O | W |
|---|---|---|---|---|---|

CLO1

29. Figure A29 shows an ascending sort using merge sort. Identify the values of **X, Y** and **Z**.
*Rajah A29 menunjukkan isihan menaik menggunakan isihan gabungan.*
*Kenal pasti nilai **X, Y** dan **Z**.*

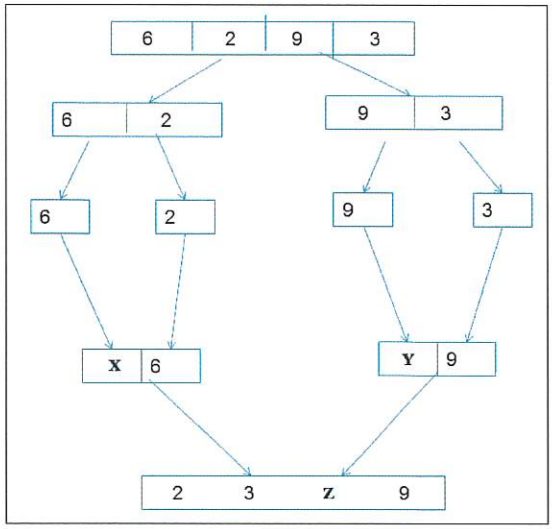



Figure A29 / *Rajah A29*

A. X=3, Y=2, Z=6

B. X=6, Y=9, Z=9

C. X=2, Y=3, Z=6

D. X=0, Y=0, Z=0

CLO1

30. Based on Figure A30, choose the **CORRECT** diagram that shows the first step in finding the number 3 using the binary search method.
*Berdasarkan Rajah A30, pilih rajah yang **BETUL** yang menunjukkan langkah pertama untuk mencari nombor 3 menggunakan kaedah carian binari.*

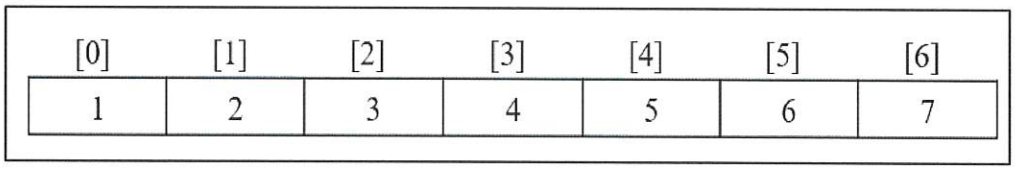
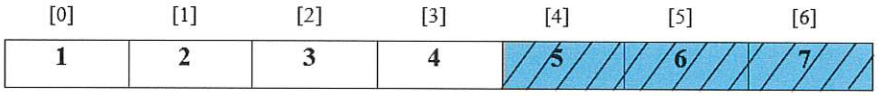
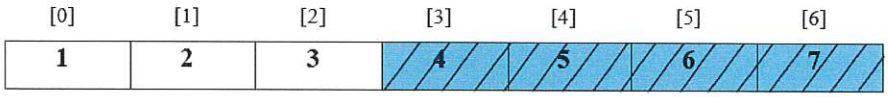



Figure A30 / *Rajah A30*

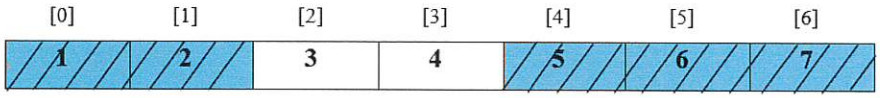
A. = 5 > 4



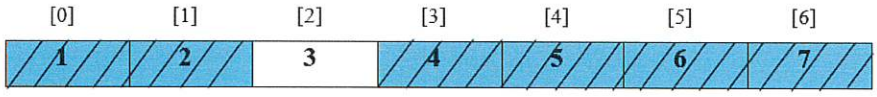

B. = 4 > 3




C. = 4 < 3




D. = 3 = = 3



**SECTION B : 55 MARKS**
***BAHAGIAN B : 55 MARKAH***

**INSTRUCTION:**
This section consists of **TWO (2)** structured questions. Answer ALL questions.

***ARAHAN :***
*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab semua soalan.*

**QUESTION 1(a)**
***SOALAN 1(a)***

CLO1

i. Define data structure.
*Definisikan struktur data.*

[2 Marks]
[*2 Markah*]

CLO1

ii. Show the appropriate structure declaration based on the information in Table B1(a)(ii).
*Tunjukkan perisytiharan struktur yang sesuai berdasarkan maklumat dalam Jadual B1(a)(ii).*

Table B1(a)(ii)/ *Jadual B1(a)(ii)*

| Type | Name | Data Type |
|---|---|---|
| Structure name | ReservationPlatform | |
| Member 1 | guest_name | 50 characters |
| Member 2 | room_type | 15 characters |
| Member 3 | total_amount | Floating point |
| Variable structure - 1 | Trivago | Until 25 records |
| Variable structure - 2 | bookingCom | Until 50 records |

[4 Marks]
[*4 Markah*]

**QUESTION 1(b)**
***SOALAN 1(b)***

CLO1

i. List **TWO (2)** types of Linked List.
*Senaraikan **DUA (2)** jenis Senarai Berpaut.*

[2 Marks]
[*2 Markah*]

CLO1

ii. Illustrate a Circular Linked List diagram with two nodes which are 'M' and 'Z.
*Ilustrasikan gambarajah Senarai Berpaut Bulat dengan dua nod iaitu ''M' dan 'Z.*

[4 Marks]
[*4 Markah*]

**QUESTION 1(c)**
***SOALAN 1(c)***

CLO1

i. State **TWO (2)** common operations in Stack implementation.
*Nyatakan **DUA (2)** operasi umum dalam implementasi Tindanan.*

[2 Marks]
[*2 Markah*]

CLO1

ii. Two potential problems that can occur in a stack are **underflow** and **overflow**. Explain the concept of **overflow** in a stack, and provide a diagram illustrating this problem.
*Dua masalah yang mungkin berlaku dalam timbunan (stack) ialah **underflow** dan **overflow**. Terangkan konsep **overflow** dalam timbunan, dan sertakan satu rajah yang menggambarkan masalah tersebut.*

[3Marks]
[*3 Markah*]

CLO1

iii. Figure B1(c)(iii) represents a stack where each index holds the name of a coffee brand. Convert this array into a single linked list structure.
*Rajah B1(c)(iii) mewakili tindanan di mana setiap indeks memegang nama jenama kopi. Tukar tatasusunan ini kepada struktur senarai berpaut tunggal.*

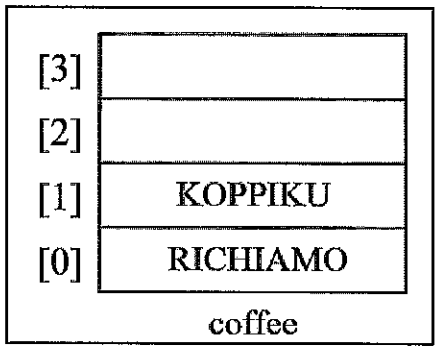



Figure B1(c)(iii) / *Rajah B1(c)(iii)*

[3 Marks]
[*3 Markah*]

**QUESTION 2(a)**

***SOALAN 2(a)***

CLO1

i. Define Queue with **TWO (2)** examples of Queue in real life.
*Definisikan Baris Gilir berserta **DUA (2)** contoh Baris Gilir dalam kehidupan sebenar.*

[4 Marks]
[*4 Markah*]

CLO1

ii. Illustrate an appropriate Circular Queue named "ArrNum" for each of the statement below including the value for front, rear and count on relevant diagram.
*Gambarkan Baris Gilir Bulat yang sesuai bernama "ArrNum" untuk setiap pernyataan di bawah termasuk nilai untuk depan, belakang dan kiraan pada rajah yang berkaitan.*

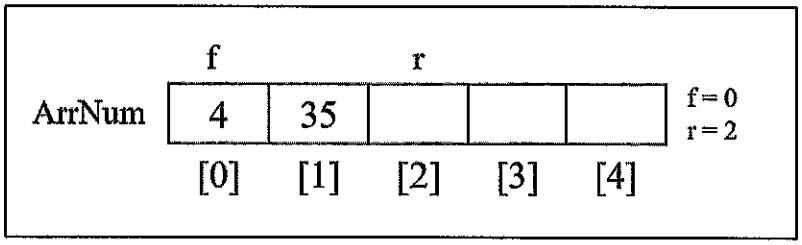



Figure B2(a)(ii) / *Rajah B2(a)(ii)*

a) Enqueue(6, ArrNum);
b) Dequeue(ArrNum);
c) Enqueue(42, ArrNum);

[6 Marks]
[*6 Markah*]

**QUESTION 2 (b)**
***SOALAN 2 (b)***

CLO1

i. Identify root node, parent node, child node and leaf node based on Figure B2(b)(i).
*Kenal pasti nod 'root', nod 'parent', nod 'child' dan nod 'leaf' berdasarkan Rajah B2(b)(i).*

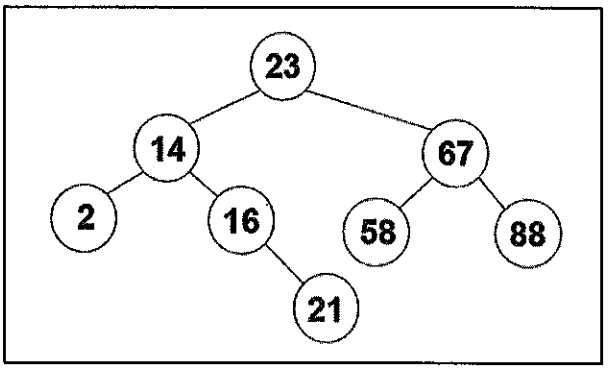



Figure B2(b)(i) / *Rajah B2(b)(i)*

[4 Marks]
[*4 Markah*]

CLO1

ii. Sketch the Binary Search Tree based on Figure B2(b)(ii).
*Lakarkan Pepohon Carian Dedua berdasarkan Rajah B2(b)(ii).*

**pink, green, yellow, grey, blue, red**

Figure B2(b)(ii) / *Rajah B2(b)(ii)*

[6 Marks]
[*6 Markah*]

CLO1

iii. Write the node sequence of Inorder, Preorder and Postorder traversal based on Binary Tree in Figure B2(b)(iii).
*Tulis urutan nod bagi traversal Inorder, Preorder dan Postorder berdasarkan Pepohon Dedua dalam Rajah B2(b)(iii).*

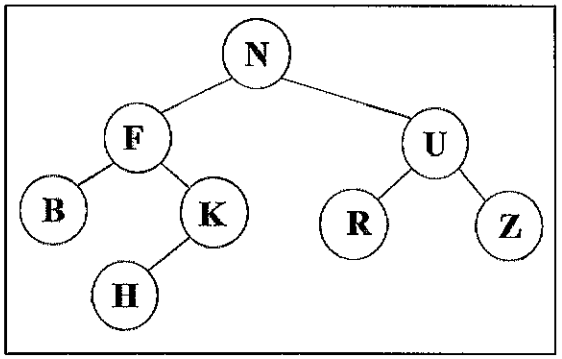



Figure B2(b)(iii) / *Rajah B2(b)(iii)*

[6 Marks]
[*6 Markah*]

**QUESTION 2(c)**
***SOALAN 2(c)***

CLO1

i. Explain **TWO (2)** differences between Linear Search and Binary Search.
*Terangkan **DUA (2)** perbezaan antara Carian Linear dan Carian Binari.*

[4 Marks]
[*4 Markah*]

CLO1

ii. Illustrate the steps to find number 100 in Figure B2(c)(ii) by using **Binary Search Method.**
*Lakarkan langkah-langkah untuk mencari nombor 100 dalam Rajah B2(c)(ii) menggunakan **Kaedah Carian Binari**.*

| 20 | 40 | 60 | 80 | 100 | 120 |
|---|---|---|---|---|---|
| [0] | [1] | [2] | [3] | [4] | [5] |

Figure B2(c)(ii) / *Rajah B2(c)(ii)*

[5 Marks]
[*5 Markah*]

**END OF QUESTIONS**
**SOALAN TAMAT**