



113 PROGRAMMING METHODOLOGY & DATA STRUCTURES

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Question 1:

Investigate the following problem:

A housing developer company builds 100 affordable houses. Each house consists of 4 rooms: a kitchen, two bedrooms and a living room. The cost of a house is based on the total area of rooms in the house. The company wants to calculate the total cost for all the houses.

Given the class Rectangle declaration:

```
class Rectangle
{
    private:
        double width;
        double length;
public:
    void setWidth(double);
    void setLength(double);
    double getWidth() const;
    double getLength() const;
    double getArea() const;
};
```

(a) Declare all the required object(s). (2 marks)

(b) Write the main C++ program to calculate the total cost of all the houses. (8 marks)

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Question 2:

Analyse the following simplified COVID-19 vaccination system that has the following steps.

Step 1: Register

People fill up their details into the system which include name, phone number, age, and health status (whether they have chronic disease and whether they have OKU status).

Step 2: Get Appointment Scheduled

The system process the details to determine their priority group and set the vaccination appointment date based on the scheduled months.

- February to April 2021:

Priority group 1: Senior citizens aged 60 and over.

- May to July 2021, comprising people in high-risk groups:

Priority group 2: Those with chronic diseases, and OKU individuals.

- August 2021 to December 2021, for the remainder:

Priority group 3: Adult population aged 18 years and above.

(a) Distinguish the suitable data structures with justification. (2 marks)

(b) Illustrate the classes by presenting the UML diagram. (4 marks)

(c) Construct the complete C++ codes using the suitable data structures. (10 marks)

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Complete your script with Index Number, Full Name and Matric Number.

Please submit your pdf-ed answer [here](#).



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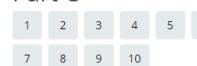
Part A



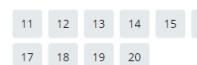
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Question 3:

Examine the following class header:

```
class Course
{
private:
    string courseName;          // Course name
    Instructor instructor;      // Instructor
    TextBook textbook;          // Textbook
public:
    Course(string course, string instrLastName,
           string instrFirstName, string instrOffice,
           string textTitle, string author,
           string publisher);
    void print();
};

class Instructor
{
private:
    string lastName;            // Last name
    string firstName;           // First name
    string officeNumber;        // Office number
public:
    Instructor();
    Instructor(string, string, string);
    void set(string, string, string);
    void print();
};

class TextBook
{
private:
    string title;               // Book title
    string author;               // Author name
    string publisher;            // Publisher name
public:
    TextBook();
    TextBook(string, string, string);
    void set(string, string, string);
    void print() const;
};
```

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(3). (a). (4 marks)

Based on the given class declaration, write the complete constructor for class Course.

(3). (b). (7 marks)

Write the functions print() for all classes where the print() function for Course will utilise the composition members.

(3). (c). (2 marks)

Write how to call the print function in main.

Quiz navigation

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Part A

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Part C

1 2 3 4 5
7 8 9 10

Part D

11 12 13 14 15
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Question 4:

Investigate the following program:

```
bool myCode(string str, int a, int b){  
    bool isTrue=false;  
    do{  
        if (str[a]== str[b]){  
            a++;  
            b--;  
            isTrue=true;  
        }  
        else{  
            isTrue=false;  
            break;  
        }  
    } while(a<b);  
    return isTrue;  
  
int main()  
{  
    int n;  
    string word;  
    bool isTrue;  
  
    cout << "Enter a word: ";  
    cin >> word;  
  
    n = word.length()-1;  
    int i = 0;  
    isTrue = myCode(word, i, n);  
  
    if (isTrue==true)  
        cout << "\nThe word \" " << word << "\" IS a word we look for.";  
    else  
        cout << "\nThe word \" " << word << "\" IS NOT a word we look for."  
  
    return 0;  
}
```

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(4). (a). (2 marks)

Identify the purpose of the above program.

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(4). (b). (5 marks)

Modify the above function into a recursive function.

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Question 5:

Analyse the following lists of nodes for a binary tree:

Preorder: srseponrsudennodomia

Inorder: pnoerssru**S**ednnodoima

Bold alphabet marks the root node of the tree.

ormation
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(5). (a). (10 marks)

Construct the binary tree above.

ormation
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(5). (b). (4 marks)

Show the post order traversal based on the constructed tree.

ormation
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Complete your script with Index Number, Full Name and Matric Number.

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Question 1

Not yet answered

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Classify which of the following belongs to the practical application of the stack data type.

Select one or more:

- a. completing task to do everyday
- b. tracking nested function calls in computer system
- c. storage of local variables in computer system
- d. tracking nested loops in programming
- e. taking turn buying groceries in Tesco during COVID

Question 2

Not yet answered

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[Edit question](#)For the following code, select the statement that is **not** TRUE.

```
class Point
{
    private:
        double y;
        double z;
    public:
        double x;
};
```

- a. The name of the class is Point.
- b. x is accessible to code that is written outside the class.
- c. z is accessible to code that is written outside the class.
- d. x, y, and z are called members of the class.

Question 3

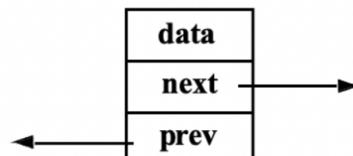
Not yet answered

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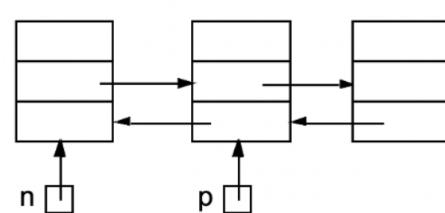
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Nodes for a doubly linked list are defined to have the following structure:



The next instance variable stores a reference to the `next` node in the list, and the `prev` instance variable refers to the previous node in the list. Below is a list of three of these nodes, along with two reference variables, `n` and `p`, that refer to specific nodes in the list.



Select the expression that does not refer to the third node in the doubly linked list.

Quiz navigation

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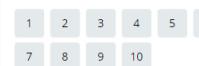
Part A



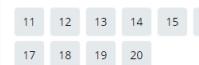
Part B



Part C



Part D



- a. n->next->next->prev->next
- b. p->prev->next->next
- c. n->next->next
- d. p->prev->next

Question 4

Not yet answered

Marked out of 1.00

Flag question

Edit question

Given the partial class declaration:

```
class Author{
    private:
        string name, hometown;
        string *genreList;
    public:
        ...
}
```

Assume all variables are properly declared.

Demonstrate which of the following is the correct way of writing the constructor.

- a. `Author(string n, string h, string g){
 name=n; hometown=h;
 for (int i=0; i<GENRE_COUNT; i++)
 genreList[i]=g;
}`
- b. `Author(){
 name=n; hometown=h;
 for (int i=0; i<GENRE_COUNT; i++)
 genreList[i]="";
}`
- c. `Author(string n, string h, string g){
 name=n; hometown=h;
 genreList = g;
}`
- d. `Author(){
 name=""; hometown="";
 genreList = new string [GENRE_COUNT];
 for (int i=0; i<GENRE_COUNT; i++)
 genreList[i]="";
}`

Question 5

Not yet answered

Marked out of 1.00

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Demonstrate the number of times the following function call itself if 5 is passed as the argument?

```
 void showMessage(int n){  
    if (n > 0)  
    {  
        cout << "Good day!" << endl;  
        showMessage(n - 1);  
    }  
}
```

- a. Four times
- b. Five times
- c. Once
- d. Infinite

Question 6

Not yet answered

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If a base class has a public member function, and the derived class has a member function with the same name with a different parameter list. Classify this function as _____.

- a. overloaded
- b. overwritten
- c. syntax error

Question 7
Not yet answered
Marked out of 1.00
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d. redefined

Select the statement which is TRUE regarding object-oriented programming.

- a. A public member function is useful for tasks that are internal to the class, but it is not directly called by statements outside the class
- b. Class objects can be defined prior to the class declaration
- c. Object encapsulates both the data and the functions that operate on the data
- d. You must declare all data members of a class before you declare member functions

Question 8
Not yet answered
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Select which of the following statement is **not** TRUE about a doubly [linked list](#).

- a. We can navigate in both the directions
- b. It requires more space than a singly [linked list](#)
- c. Traversing in forward or backward manner is easier in a doubly [linked list](#) than a singly [linked list](#)
- d. The insertion and deletion of a node take a bit longer

Question 9
Not yet answered
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When working with a binary tree, a node that has more than two children _____.

- a. is theoretically impossible in a correctly developed binary tree structure
- b. is known as a triplet node
- c. will be cut back by the compiler
- d. None of these

Question 10
Not yet answered
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Given the following code, assume the `myQueue` object is a queue that can hold integers and that `value` is an `int` variable.

```
1 myQueue.enqueue(10);
2 myQueue.enqueue(20);
3 myQueue.enqueue(30);
4 myQueue.dequeue(value);
5 myQueue.dequeue(value);
6 myQueue.enqueue(value);
7 cout << value << endl;
```

Assume that the `dequeue` function, called on lines 4 and 5, stores the number removed from the queue in the `value` variable. Report what the statement on line 7 display.

- a. 10
- b. 30
- c. 20
- d. None of these

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Question 11

Not yet answered

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Given the following class declaration, show the correct overloading constructor for object PreLoved.

```
class toSell{
protected:
    string category;
    string itemType;
    string location;
public:
    toSell();
    toSell(string, string, string);
    ~toSell();
    void setDetails(string, string, string);
    void getDetails(string&, string&, string&);
    string chooseCategory();
};

class PreLoved:public toSell{
    string name;
    string type;
    float price;
public:
    PreLoved();
    ~PreLoved();
    void setDetails(string, string, float);
    void getDetails(string&, string&, float&);
};
```

Select one or more:

- a.

```
PreLoved::PreLoved(string n, string t, float p){
    name=n; type=t; float=p;
}
```
- b.

```
PreLoved::PreLoved():toSell(){
    setDetails("", "", 0.0);
}
```
- c.

```
PreLoved::PreLoved(string n, string cat, string loc, float p)
    :toSell(cat, loc){
    name=n; type=""; float=p;
}
```
- d.

```
PreLoved::PreLoved(){
    name=""; type=""; float=0.0;
}
```
- e.

```
void PreLoved::setDetails(string n, string t, float p){
    name=n; type=t; float=p;
}
```

Question 12

Not yet answered

Marked out of 3.00

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Given an input sequence 1, 2, 3, 4, 5. Assuming this stack operates push and pop randomly. Illustrate all the possible **incorrect** output sequence in order to empty a stack.

Select one or more:

- a.
1, 5, 2, 3, 4
- b.
5, 4, 3, 1, 2
- c.
3, 4, 5, 2, 1
- d.
3, 4, 5, 1, 2

Quiz navigation

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Part A



Part B



Part C



Part D



Question 13

Not yet answered

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Given the following C++ codes segment on insertion a node into an ordered doubly [linked list](#). Demonstrate the correct insertion case.

```
newnode = new ListNode<T>;
newnode->value = newItem;
newnode->next = nullptr;
newnode->previous = nullptr;

found = false;
nodePtr = head;

while (nodePtr != nullptr && !found) {
    if (nodePtr->value >= newItem)
        found = true;
    else {
        trailPtr = nodePtr;
        nodePtr = nodePtr->next;
    }
}

if (nodePtr != nullptr)
{
    trailPtr->next = newnode;
    newnode->previous = trailPtr;
    newnode->next = nodePtr;
    nodePtr->previous = newnode;
}
```

- a. Case 2: Insertion at the beginning of a nonempty list
- b. Case 4: Insertion somewhere in a nonempty list
- c. Case 3: Insertion at the end of a nonempty list
- d. Case 1: Insertion in an empty list

Question 14

Not yet answered

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Show the purpose of the following C++ codes.

```
void LinkedList<T>::processNode(T searchValue)
{
    ListNode<T> *nodePtr;
    ListNode<T> *previousNode;
    bool found = false;

    if (!head)
        cout << "List is Empty\n";
    if (head->value == searchValue) {
        nodePtr = head;
        head = head->next;
        head->next = nodePtr->next;
        delete nodePtr;
        count--;
    }
    else
    {
        nodePtr = head;
        while (nodePtr->value != searchValue && nodePtr->next != head) {
            previousNode = nodePtr;
            nodePtr = nodePtr->next;
        }
        if (nodePtr->value == searchValue) {
            previousNode->next = nodePtr->next;
            delete nodePtr;
            count--;
        }
        else
            cout << "Cannot delete the value " << searchValue << endl;
    }
}
```

- a. Search and delete node from a doubly [linked list](#)

- b. Search and delete node from a [linked list](#)
- c. Search and delete node from a circular [linked list](#)
- d. None of these

Question 15

Not yet answered

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Compute the following C++ codes, which correctly output the value 45.

- a.

```
#include <iostream>
using namespace std;
class TestClass
{
public:
    TestClass(int x)
    { cout << "Hello" << endl; }
    TestClass()
    { cout << "Hello!" << endl; }
};
int main()
{
    TestClass test(45);
    return 0;
}
```
- b.

```
#include <iostream>
using namespace std;
class TestClass
{
public:
    TestClass(int x)
    { cout << x << endl; }
    TestClass()
    { cout << "Hello!" << endl; }
};
int main()
{
    TestClass test(45);
    return 0;
}
```
- c.

```
#include <iostream>
using namespace std;
class TestClass
{
private:
    int val;
    void showVal()
    { cout << val << endl; }
public:
    TestClass(int x)
    { val = x; }
};
int main()
{
    TestClass test(77);
    test.showVal();
    return 0;
}
```
- d.

```
#include <iostream>
using namespace std;
class TestClass
{
public:
    TestClass(int x)
    { cout << x << endl; }
    TestClass()
    { cout << "Hello!" << endl; }
};
int main()
{
    TestClass test("45");
    return 0;
}
```

Question 16

Not yet answered

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[Edit question](#)

Demonstrate the valid constructor definitions for the following C++ codes.

```
class Employee
{
private:
    string name;           // Employee's name
    int idNumber;          // ID number
    string department;     // Department name
    string position;       // Employee's position

public:
    // Constructors
    Employee(string, int, string, string);
    Employee(string, int);
    Employee();
    // Mutators
    // Accessors
};
```

- a. `Employee::Employee(string n, int i)`
`{`
 `name = n;`
 `idNumber = i;`
 `department = "";`
 `position = "";`
`}`
- b. All of these
- c. `Employee::Employee(string n, string i, string d, string p)`
`{`
 `name = n;`
 `idNumber = i;`
 `department = d;`
 `position = p;`
`}`
- d. `Employee::Employee()`
`{`
 `name = "";`
 `idNumber = "";`
 `department = "";`
 `position = "";`
`}`

Question 17

Not yet answered

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[Edit question](#)

Show member(s) of the following class declaration:

```
6 class Course{
7     protected:
8         int size;
9         struct courseDetails{
10            string code;
11            float marks;
12        } *my;
13     public:
14         Course()
15         ~Course();
16         void getCourse();
17         void setCourse();
18         void setSize(int);
19         Course operator==(Course);
20         friend Course operator++(Course);
21 }
```

Select one or more:

- a.

```
        string code;

 b.
    course operator==(Course);

 c.
    courseDetails *my;

 d.
    ~Course();

 e.
    friend Course operator++(Course);
```

Question 18

Not yet answered

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Edit question

Given the `IntList` class, demonstrate which one of the following that correctly insert a value `x` at position `y` in a linked list?

```
class IntList
{
private:
    struct ListNode
    {
        int value;
        struct ListNode *next;
    };
    ListNode *head;
    void destroy();

public:
    IntList()
    { head = nullptr; }
    IntList(const IntList &);
    ~IntList();
    void insert(int, int);
};
```

- a. `void IntList::insert(int x, int y)`

```
{
    ListNode *newNode = new ListNode;
    newNode->value = x;
    newNode->next = nullptr;

    if (head == nullptr)
    {
        head = newNode;
        return;
    }
    if (y == 0)
    {
        newNode->next = head;
        head = newNode;
        return;
    }

    ListNode *p = head;
    int num = 1;
    while (num <= y)
    {
        if (p->next == nullptr || num == y)
        {
            ListNode *tempPtr = newNode;
            p->next = newNode;
            newNode->next = tempPtr;
            return;
        }
        p = p->next;
        num++;
    }
}
```
- b. `void IntList::insert(int x, int y)`

```
{
    ListNode *newNode = new ListNode;
    newNode->value = x;
    newNode->next = nullptr;

    if (head == nullptr)
    {
        head = newNode;
        return;
    }
    if (y == 0)
    {
        newNode->next = head;
        head = newNode;
        return;
    }
```

```

    }

    ListNode *p = head;
    int num = 1;
    while (num <= y)
    {
        if (p->next == nullptr)
        {
            ListNode *tempPtr;
            p->next = newNode;
            newNode->next = tempPtr;
            return;
        }
        p = p->next;
        num++;
    }

    c. void IntList::insert(int x, int y)
    {
        ListNode *newNode = new ListNode;
        newNode->value = x;
        newNode->next = nullptr;

        if (head == nullptr)
        {
            head = newNode;
            return;
        }
        if (y == 0)
        {
            newNode->next = newNode;
            head = newNode->next;
            return;
        }

        ListNode *p = head;
        int num = 1;
        while (num <= y)
        {
            if (p->next == nullptr || num == y)
            {
                ListNode *tempPtr = p->next;
                p->next = newNode;
                newNode->next = tempPtr;
                return;
            }
            p = p->next;
            num++;
        }

    }

    d. void IntList::insert(int x, int y)
    {
        ListNode *newNode = new ListNode;
        newNode->value = x;
        newNode->next = nullptr;

        if (head == nullptr)
        {
            head = newNode;
            return;
        }
        if (y == 0)
        {
            newNode->next = head;
            head = newNode;
            return;
        }

        ListNode *p = head;
        int num = 1;
        while (num <= y)
        {
            if (p->next == nullptr || num == y)
            {
                ListNode *tempPtr = p->next;
                p->next = newNode;
                newNode->next = tempPtr;
                return;
            }
            p = p->next;
            num++;
        }
    }
}

```

Question 19
Not yet answered
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Flag question
[Edit question](#)

Given N is the number of a multiplication table and i is the index, which of the following recursive function is applicable to write incremental multiplication table?

Select one or more:

a.
Given i is 1
`cout << N << " * " << i << " = " << N * i << endl;`
`if(i<10)`
`| | return my_mul_table(N, i+1);`

b.
Given i is 10
`if (i==0)`
`| | return N;`
`cout << N << " * " << i << " = " << N* i << endl;`
~~.....~~

```

my_mul_table(N, i - 1);

 c.
Given i is 10
if (i==0)
|    return;

my_mul_table(N, i - 1);
cout << N << " * " << i << " = " << N * i << endl;

 d.
Given i is 10
if(i<10)
|    return my_mul_table(N, i+1);
cout << N << " * " << i << " = " << N * i << endl;

 e.
Given i is 1
if (i > 10)
|    return;

cout << N << " * " << i << " = " << N * i << endl;
return my_mul_table(N, i + 1);

```

Question 20

Not yet answered

Marked out of 3.00

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Suppose that we have numbers between 1 and 100 in a **binary search tree** and want to search for the number 54. Illustrate which of the following sequences CAN be the sequence of nodes examined.

Select one or more:

- a. {10, 75, 64, 43, 60, 57, 54}
- b. {9, 85, 47, 68, 43, 57, 54}
- c. {79, 14, 72, 56, 16, 53, 54}
- d. {90, 12, 68, 34, 62, 45, 54}

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