

Object-Oriented Programming (OOP) comes with many principles.

Choose only FOUR (4) of them and briefly describe the key concept of each principle with an appropriate example.

Answers:

(OOP) Principles that been chosen Classes, Object, Encapsulation, Data Hiding, Association, Inheritance, Polymorphism

Classes:

A class is the template or mould or blueprint from which objects are made.

Object:

Each object that is created from a class is called an instance of the class.

Encapsulation:

Combining attributes and methods in one package and hiding the implementation of the data from the user of the object.

Data Hiding:

Data hiding ensures methods should not directly access instance attributes in a class other than their own.

Association:

Relates classes to each other through their objects.

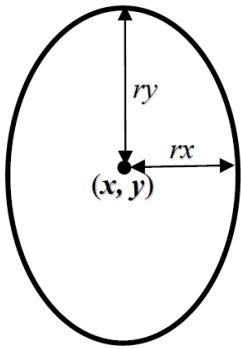
Inheritance:

is the ability of one class to **extend** the capabilities of another. It allows code defined in one class to be reused in other classes.

Polymorphism:

is the ability of objects **performing the same actions** differently .

An ellipse can be represented by its centre point (x, y) , horizontal radius, rx and vertical radius, ry as shown in the figure below.



A circle is a special type of an ellipse in which rx and ry are the same length.

Given the definition of a class representing an ellipse in the program below.

```
class Ellipse
{
    private:
        int x, y;
        int rx, ry;
    public:
        Ellipse() {x=y=rx=ry=0;}
        Ellipse(int r) { x=y=0; rx=ry=r;}
        Ellipse(int _rx, int _ry) {x=y=0; rx=_rx; ry=_ry;}
        Ellipse(int _x, int _y, int r ) {x=_x; y=_y; rx=ry=r;}
        Ellipse(int _x, int _y, int _rx, int _ry) { x=_x; y=_y; rx=_rx; ry=_ry;}
        void setRadius(int _rx, int _ry){rx=_rx; ry=_ry;}
};
```

Questions:

1. In general, what is the purpose of having several constructors in a class?
2. Write five different code in which each code will be creating a circle with the centre at the origin $(0,0)$ and the radius of 10 unit from the class *Ellipse*.
3. What if the class *Ellipse* is added with another constructor as given below?
Ellipse(int _x, int _y) {x=_x; y=_y; rx=ry=0;}

Justify your answer.

Answers:

Consider the class *Data* and functions *increaseDataValue* and *decreaseDataValue* in the program below.

```
#include<iostream>
using namespace std;

class Data
{
    private:
        int value;
        int *link;
    public:
        Data( int _value, int * _link)
        {
            value = _value;
            link = _link;
        }
        Data(const Data &data)
        {
            value = data.value;
            link = data.link;
        }
        ~Data()
        {
            cout << "Data with value " << value << " is being destroyed" << endl;
        }
        int getValue() const { return value;}
        void setValue(int _value) { value = _value;}
        void setLinkContent(int number) { *link = number;}
        void print() const
        {
            cout << "value contains " << value << endl;
            cout << "link points to " << *link << endl << endl;
        }
};

void increaseDataValue(Data data)
{
    int val = data.getValue();
    val = val + 10;
    data.setValue(val);
}

void decreaseDataValue(Data& data)
{
    data.setValue(data.getValue() - 5);
}
```

Questions:

1. Assume the main function of the program is as below.

What is the output of the program as printed by each of the following lines?

```
int main()
{
    int number = 5;
    Data data1(100, &number);
    data1.print(); //Output 1
    Data data2 = data1;
    data2.print(); //Output 2
    data1.setLinkContent(9);
    data2.setLinkContent(11);
    data2.setValue(88);
    data1.print(); //Output 3
    data2.print(); //Output 4
    return 0;
}
```

| Lines | Output | |
|----------------|--------|---|
| data1.print(); | 1 | value contains 100 link points to 5 |
| data2.print(); | 2 | value contains 100 link points to 5 |
| data1.print(); | 3 | value contains 100 link points to 11 |
| data2.print(); | 4 | value contains 88 link points to 11 |

2. If the main function is changed to as follows, determine the value of variables *a*, *b*, and *c*.

```
int main()
{
    int a, b, c;
    Data data(100, NULL);
    a = data.getValue();
    increaseDataValue(data);
    b = data.getValue();
    decreaseDataValue(data);
    c = data.getValue();
    return 0;
}
```

| Variables | Output |
|-----------|--------|
| a | 100 |
| b | 100 |
| c | 95 |

3. If the main function is changed to as follows, determine the sequence of the destruction of the objects by writing the output printed from the destructor in order.

```
int main()
{
    int x = 777;
    Data *ptrData;
    Data data(1, &x);
    ptrData = new Data(7, &x);
    if (ptrData->getValue() > data.getValue())
    {
        Data subData(11, &x);
    }
    delete ptrData;
    return 0;
}
```

Answer:

Data with value 11 is being destroyed

Data with value 7 is being destroyed

Data with value 1 is being destroyed

Given the program below which is intended to read a list of cars from a binary file and calculate the total price of all the cars.

```
#include <iostream>
#include <cstdlib>
#include <fstream>
using namespace std;

class Car
{
    private:
        int year;
        double price;
    public:
        Car(int year=0, double price=0.0)
        {
            this->year = year;
            this->price = price;
        }
        double getPrice() const{ return price; }
        static void fileCheck(__(a)__)
        {
            if (__ (b) __)
            {
                cout << "Error! File not found..";
                exit(1);
            }
        }
};

int main()
{
    Car cars[100]; // To store the list of cars read from the file
    fstream fin;
    string fileName;
    int fileSize; // The size of file (number of bytes)
    int objectSize; // The size of each Car object (in number of bytes)
    int nCars; // The number of Car objects in the file.
    cout << "Enter the input file's name => ";
    cin >> fileName;
    __(c)____
    __(d)____
    __(e)____
    __(f)____
    __(g)____
    __(h)____
    __(i)____
    fin.close();
    double totalPrice = 0;
    __(j)____
    cout << "Total car price: " << totalPrice << endl;
    return 0;
}
```

Questions:

The user will need to enter the file's name that contains the list of cars.

Write the correct C++ code to perform the following tasks.

1. Specify an appropriate parameter for the method *fileCheck*.
This method will take a file as its parameter.
2. Write the condition to check whether the file is opened successfully.

3. The file's name used in your computer system is in small letters.
However, the user might be entering the name in capital letters or mixed cases.
Thus, convert the file's name to small letters.
4. Open the file as a binary input file.
5. Invoke the method *fileCheck* to check the input file has been opened successfully.
6. Determine the size of the input file in bytes.
7. Determine the size of each *Car* object.
8. Determine how many cars in the input file.
9. Read all the *Car* objects from the input file into the array *cars*.
10. Calculate the total price.

Answers:

The program below is meant for converting money from a foreign currency (USD, GBP, CNY, or SGD) to Malaysian Ringgit (MYR).

```
#include <iostream>
#include <string>
#include <cctype>
#include <cstdlib>
using namespace std;

int main()
{
    string money;
    string currency;
    string value;
    double moneyValue, myrValue;

    cout<<"Enter the money with currency (e.g. USD 10.50) => ";
    getline(cin, money);
    currency = money.substr(0,3);
    value = money.substr(4,money.length()-4);
    moneyValue = atof(value.c_str());

    for (int i=0; i<currency.length(); i++)
        currency[i] = toupper(currency[i]);
    if (currency=="USD") myrValue = moneyValue * 4.18;
    else if (currency=="GBP") myrValue = moneyValue * 5.44;
    else if (currency=="CNY") myrValue = moneyValue * 0.61;
    else if (currency=="SGD") myrValue = moneyValue * 3.05;

    cout << money << " is equivalent to " << "MYR " << myrValue << endl;
    return 0;
}
```

The user might enter the foreign currency in small or capital letters or combination of them.

Based on the program, state what each code segment (1) to (3) below is doing and give the reason why it is necessary to do so.

Answers:

| code segment | what this code segment is doing | why it is necessary to do |
|--|--|--|
| currency = money.substr(0,3); value = money.substr(4,money.length()-4); | For the first line taking the input of string and use function money.substr(0,3) to take the first three substring then assigned to currency. Next, another substring function is use to take the value in the string and assigned to specific variable which is value | To assign the input to specific variable such as currency and value because both input will do different operation forward such as currency is to determine the calculation needed to do with the value variable |
| moneyValue = atof(value.c_str()); | Using atof function to change the string value into a floating data type | The string value need to change to floating data type because they will use the value to do and multiplication operation |
| for (int i=0; i<currency.length(); i++) currency[i] = toupper(currency[i]); | To change all currency data into upper class word | To make sure its easy to use if statement during comparison of currency type |

