CEC 101: Computer Programming

Civil Engineering Autumn 2023-24

Practical 8: Structures and Classes

Q1. Create a structure called Payroll to manage employee payroll information, which shall include their name, hours worked, hourly rate and total salary payable.

a) Define two functions to take employee details input and calculate the salary.
b) Define an array of type Payroll to take multiple employee entries.
c) Create a structure DOB inside Payroll to take the employee date of birth as input. DOB shall contain year, day, and month.

Q2. Define a C++ structure "Point" to represent a point in 2D space with attributes for the x and y coordinates (both integers).

a) Take two Point variables as input and calculate the distance between them.
b) Take a third Point variable and determine if it is co-linear with the first two.

Q3. Create a C++ class named 'Student' that contains the following private members: Enrollment no. (an integer), name (a string), grade (integer). The class should have member functions to set and get the values of these members and a function to display the student's information. Create an object of the 'Student' class in your main function and demonstrate how to use its member functions to set, get, and display the student's information.

Q4. Create a C++ class called "Circle" that has the following features:

a) A private member variable to store the radius of the circle.
b) A constructor that initializes the radius when an object of the class is created.
c) A member function to calculate and return the area of the circle.
d) A member function to calculate and return the circumference of the circle.

Create an object of the "Circle" class in the main() function and set its radius. Calculate and display the area and the circumference of the circle using the appropriate member function.

Q5. Create a class called 'Matrix' containing a constructor that initializes the number of rows and the number of columns of a new Matrix object. The Matrix class has the following information:

a) Number of rows of matrix
b) Number of columns of matrix
c) Elements of matrix (You can use 2D vector)

The Matrix class has functions for each of the following:

a) Get the number of rows,
b) Get the number of columns,
c) Set the elements of the matrix at a given position (i,j),
d) Adding two matrices,
e) Multiplying the two matrices

You can assume that the dimensions are correct for multiplication and addition.

Q6. Predict and justify the output of following programs: -

```
class Empty {};

int main()
{
        cout << sizeof(Empty);
        return 0;
}
```

a) A non-zero value
b) 0
c) Compile Error
d) Runtime Error

```
class Test {
  int x;
};
int main()
{
        Test t;
        cout << t.x;
        return 0;
}
```

a) 0
b) Garbage Value
c) Compile Error

Assume that an integer and a pointer each take 4 bytes. Also, assume that there is no alignment in objects.

```
class Test
{
        static int x;
        int *ptr;
        int y;
};

int main()
{
        Test t;
        cout << sizeof(t) << " ";
        cout << sizeof(Test *);
}
```

a) 12 4
b) 12 12
c) 8 4
d) 8 8

Special problem: Let us work on the menu of a library. Create a structure containing book information like accession number, name of author, book title and flag to know whether book is issued or not.
Create a menu in which the following can be done.

1 - Display book information
2 - Add a new book
3 - Display all the books in the library of a particular author
4 - Display the number of books of a particular title
5 - Display the total number of books in the library
6 - Issue a book

(If we issue a book, then its number gets decreased by 1 and if we add a book, its number gets increased by 1)