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Subject: CS102: Problem Solving using Object Oriented Programming

Class: F.E Engineering, Sem II

Practice Questions for ESE

1) Program on Encapsulation: Write a program to demonstrate classes and objects

1. Create a class Cow, representing a cow in a dairy herd. The class should include a name, an ID number, a date of birth, and a date of most recent calving. Also write a method that adds the ability to keep a total of milk output, to enter a value for a milking, and to compute average milk production. The method should also support the ability to reset the total milk output value to zero. Create appropriate objects and use setter methods to initialise the objects and getter methods to extract the values of these objects.
2. Define a class to represent a bank account.Include the following members:

   Data members
   a. Name of the depositor
   b. Account number
   c. Type of account
   d. Balance amount in the account

   Member function
   a. To assign initial value
   b. To deposit an amount
   c. To withdraw an amount after checking the balance
   d. To display name and balance

   Write a main program to test the program.

3. Create a program using class to process Shopping List for a departmental store. The list should include details like Code No , Name and Price for each item.The actions performed on the list should be able to display the name and price for entered code number (Code No) of the item. There should also be a provision to add new item as initially the list is empty and then to delete an existing item. Also all the items need to be shown with CodeNo, Name and Price and then total of all the prices.

2) Program on Encapsulation: Write a program to demonstrate constructor

1. Create a class 'Employee' with three data members which are name, age and Salary. The constructor of the class assigns default values name as "unknown", age as '18' and salary as 20000. Write the setter and getter methods for class Employee. Write another method which prints the name, age and Salary of 10 employees sorted according to their age.
2. Design the constructor for the class designed in Exp1.2.
3. Write a Program to generate Fibonacci Series by using Constructor to initialize the Data Members.

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4) Program on Polymorphism: Implement a Program to demonstrate method overloading

1. Create a Date class with data int year, int month, int date, int hrs, int min, int sec. Create a default, no-argument constructor which sets the default date to January 1, 2000, 00:00:00
   Create 3 overloaded setter methods
   void setDate(int year, int month, int date)
   void setDate(int year, int month, int date, int hrs, int min)
   void setDate(int year, int month, int date, int hrs, int min, int sec)
   Also write a displayDate() method which will display the date depending on the type of date object created.

2.Write a C++ program to implement method overloading by implementing the Power class which contains a function raisePower() to raise a number a b in the following different forms .

a. The function takes a DOUBLE value for a and INT value for b.
   Use a default value of 2 for b to make the function to calculate squares when this argument is omitted.
b. Implement another function that performs the same operations but takes INT for both a and b.

3.Write a program that overloads absolute 3 functions namely absolute that return absolute values of int, floating point number and double.

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3)Program on Polymorphism: Implement a Program to demonstrate constructor overloading

1.

Write a menu-driven program to recruit an employee (depending on his performance in various rounds) in some software company using constructor overloading.
Selection Criteria for each post is given below:
i) Programmer (Minimum total of 80 marks):-
Rounds:-
(1) Course Work
(2) Aptitude Test
(3) Technical Test
(4) Interview
ii) Team Leader (Minimum total of 85 marks):-
Rounds:-
(1) Technical Test
(2) Interview
iii) Project Manager (Minimum score 90 marks)
Rounds:-
(1) Interview

Create a class Posting and write 3 constructors to initialize the object and set the parameters and display the employee post according to selection criteria.
Data members:
● int courseWork;
● int AptTest;

● int TechTest;
● int interview;
Methods:
● Posting (int courseWork, int AptTest, int TechTest,int interview)
● Posting (int TechTest,int interview)
● Posting (int interview)
Make use of 'this' keyword.

2.Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imag parts to equal values and third which takes two argument is used to initialized real and imag to two different values.

3.Write a program for finding area of different geometric shapes (circle, rectangle, cuboid). Use constructor overloading with type, order, sequence of arguments to find the area of shapes.

5) Program on Polymorphism: Implement a Program to demonstrate method overriding

Consider a class Product with data members barcode and name of the product. Create the appropriate constructor and write getter methods for the individual data members. and write two virtual methods, scanner() and printer().
Derive 2 classes from Product, 1st class is PrepackedFood and 2nd class is FreshFood. the PrepackedFood class should contain the unit price and the FreshFood class should contain a weight and a price per kilo as data members. Override the methods scanner and printer in the derived classes. (These methods will simply output product data on screen or read the data of a product from the keyboard depending upon whether it is Prepacked or FreshFood) In main, create a base class pointer and point it to the appropriate derived class objects to demonstrate runtime polymorphism.

Create class person with attributes phone_number, name and a method read()for getting and setting the name and phone_number. Include a method show() to display the phone_number and name. Derive class student from person with attributes roll_number ,course and method read to override that in base class person. In this read() method give a call to the base class read() and ask for setting roll_number and course. Here also include a method show() which initially calls the base class method show() and then displays the roll_number and course.

3.Create a base class called Shape.Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called Triangle and Rectangle from the base Shape. Add to the base class, a member function get_data() to initialize base class data members and another member function display_area() both as virtual functions and redefine these functions in the derived classes to suit the requirements.
Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively, and display the area.
Remember the two values are given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows:
Area of rectangle = x*y
Area of triangle = ½ *x*y
In main, create a base class pointer and point it to the appropriate derived class objects to demonstrate runtime polymorphism.

6) Program on Inheritance: Implement a Program to demonstrate single, multilevel Inheritance

1. Create a class called Employee with data members emp_id and name. Write a parameterized constructor and getter methods for the data members of the Employee class. Next, create two classes FullTimeEmployee and PartTimeEmployee derived from the Employee class using public mode of inheritance. FullTime Employee receives salary monthly and has data members basic salary, dearness allowance and HRA. Total monthly salary is equal to sum of all the above data members. Write a calculateSalary() method for computing a full time employee's monthly salary. PartTime Employees are paid on an hourly basis with the rate of payment per hour and the total number of hours worked stored as data members. Write a calculateWages() method for computing the daily wages of a given Part Time Employee assuming that the employee has worked for a period of 30 days. Write appropriate constructors for the derived classes. Also write a menu-driven main() function which simulates the above scenario.

2. Mr John is given the contract to colour the house . Design a c++ program that implements multi- level inheritance in such a way that
   - ○ There must be 3 classes i.e. Exterior ,Paint ,Bill.
   - ○ The Class Bill inherits the Paint class which in turn inherits the Class Exterior
   - ○ Class Exterior contains a function to find the area of the house
   - ○ Class Paint contains a function to select the paint type and brand
   - ○ Class Bill calculates the final cost of the painting by getting the house details and paint details.

- Write a main() function to create appropriate objects and simulate the above scenario.

3. a. Design three classes: STUDENT, EXAM and RESULT. The STUDENT class has data members such as rollno, name. EXAM is created by inheriting STUDENT. EXAM class adds data members representing the marks scored in six subjects. Derive RESULT from EXAM and has its own data members such as totalmarks. Write a program to model this relationship.
   b.Taking person as base class: Attributes: Name,gender,age Function : get_data()
   Worker derived from person: Attributes: base_salary,shift(in hours) Function: Set_data()
   Manger derived from worker: Attributes: dept,no of people(subordinates or people working under him/her),bonus Function:display_payment()
   Display the total payment. Total payment calculated as : TP=(base_salary*shift)+(no o people* bonus)

7) Program on Inheritance: Implement a Program to demonstrate multiple Inheritance

Define a class called Home with two data members used to store the number of rooms and the size in square meters. Supply default values for your constructor definition to create a default constructor. In addition to accessor methods, also define the method display(), which outputs the data members of an apartment.
Define another class called Car with data members used to store car number, seating capacity and model name. Add appropriate constructors and member functions.
Define a class derived from the Car and Home classes called MotorHome, which is used to represent motorhomes. Inheritance of public base classes is used.The MotorHome class contains a new data member used to store one value of the CATEGORY type. CATEGORY represents the categories "Luxury," "First Class," "Middle Class," and "Economy". In addition to defining a constructor with default values, also define appropriate access methods and a display() method for output.
Write a menu driven main function to test the above scenario.

3.Imagine a publishing company that markets both book and audiocassette versions of its works.

Create a class publication that stores the title (a string) and price (type float) of a publication. For this class consider two base classes: book, which adds a page count (type int), and tape, which adds a playing time in minutes (type float). Each of these three classes should have a getdata() function to get its data from the user at the keyboard, and a putdata() function to display its data. Write a main() program to test the book , tape and publication classes by creating instances of them, asking the user to fill in data with getdata(), and then displaying the data with putdata().

8) Program on Abstraction: Implement a Program to demonstrate Abstraction using abstract class

The Coworker class represents human resources data for a company. The class is used as a base class for various employees, blue-collar, white-collar, and freelancers. The Coworker class has only a name, address of an employee, and the division where the employee works as data members.
Create a base class called CoWorker with the given data members. Write virtual functions for computing income and displaying the worker's details and appropriate constructor and destructor(virtual). Create a derived class called Laborer which adds data members wages and hours. Class Laborer must override the income and display methods and have constructor, destructor and other appropriate methods. Create another derived class called Employee with data member salary. Class Employee must override the income and display methods of CoWorker class and have constructor, destructor and other appropriate methods. In main, create an array of pointers of CoWorker type and initialize them to different objects of derived classes (Employee/Laborer) stored on heap memory. Call the display and income methods for these objects using the base class pointer. Delete the objects created to show the appropriate destructor calls.

3.Create a base class as a Vehicle. The Vehicle class has wheels and engine capacity as data members.and two pure virtual functions spec() to set the values for data members and display_stats() to display the values assigned. Create classes LMV(Light Motor Vehicle),HMV(Heavy Motor Vehicle) and TW(Two Wheeler) publicly derived from the Vehicle class. Include variables like speed,mileage and rpm in the derived classes and override the virtual methods in these classes.Also have constructor initializing the values to 0 as default and a virtual destructor for the classes.In main create an array of pointers of the base class and set them to the objects of the derived classes.
Now make a call to the various methods for these objects using the base class pointer. Delete the objects created to show the appropriate destructor calls.

9) Program on Abstraction: Implement a Program to demonstrate STL

Create a class Book with private data members title, author and year of publication. Write appropriate constructors for the same. Write a display() method to display a book's details and a getter method for getting a book's title. In main, create a vector to store book objects. Create a menu with the options: Add a book, Display all books, Search a book by title, Exit.
Add a book should be able to add a given book to the vector you created. Display all books should be able to traverse through the vector of books created(Use an iterator for vector for the same). Search a book should be able to search for a given book through the iterator for the vector of books.
Sample dialog is shown:

```
1. Add a book
2. Display books
3. Search a book
4. Exit
Enter your choice:1
Enter title:More than Human
Enter author:Sturgeon, Theodore
Enter year:1953
1. Add a book
2. Display books
3. Search a book
4. Exit
Enter your choice:1
Enter title:At Home in the Universe
Enter author:Kauffman
Enter year:1996
1. Add a book
2. Display books
3. Search a book
4. Exit
Enter your choice:1
Enter title:Object Oriented Programming with C++
Enter author:Balagurusamy
Enter year:2008
1. Add a book
2. Display books
3. Search a book
4. Exit
Enter your choice:2
Title:More than Human
Author:Sturgeon, Theodore
Year:1953
Title:At Home in the Universe
Author:Kauffman
Year:1996
Title:Object Oriented Programming with C++
Author:Balagurusamy
Year:2008
1. Add a book
2. Display books
3. Search a book
4. Exit
Enter your choice:3
Enter the book title:At Home in the Universe
Title:At Home in the Universe
Author:Kauffman
Year:1996
1. Add a book
2. Display books
3. Search a book
4. Exit
Enter your choice:3
Enter the book title:Problem Solving with C++
Sorry, this book is not available!
1. Add a book
2. Display books
3. Search a book
4. Exit
Enter your choice:4
```

2. Write a program which mimics a voting system for awarding the best movie. Your program must first read the total number of votes received. Next it must read the movie names one by one. A movie name entered means a vote received for the movie. Calculate the total votes received for each movie, and output it along with the movie name. Find and print the best movie. Use a map to calculate the output. Your map should index from a string representing each movie's name to integers that store the sum of the votes for the movie.

Sample input:

```
Enter the no. of votes:7
Enter movie name to resemble each vote one to a line:
Harry Potter and the Order of the Phoenix
Harry Potter and the Order of the Phoenix
The Bourne Ultimatum
Harry Potter and the Order of the Phoenix
The Bourne Ultimatum
Wall-E
Glitter
```

Output for the above Input:

```
Glitter: 1
Harry Potter and the Order of the Phoenix: 3
The Bourne Ultimatum: 2
Wall-E: 1
Best Movie: Harry Potter and the Order of the Phoenix
```

3.1 Create a class student that includes a student's first name and his roll_number. Create five objects of this class and store them in a list thus creating a phone_lit.Write a program using this list to display the student name if the roll_number is given and vice-versa.
3.2Create an array with even numbers and a list with odd numbers.Merge two sequences of numbers into a vector using merge() algorithm.Display vector.

10) Program to demonstrate exception handling.

1.Write a program that converts dates from numerical month/day format to alphabetic month/day (for example 1/31 or 01/31 corresponds to January 31).
You will define two exception classes, one called MonthError and another called DayError. If the user enters anything other than a legal month number (integers from 1 to 12), then your program will throw and catch a MonthError. Similarly, if the user enters anything other than a valid day number (integers from 1 to either 29, 30, or 31, depending on the month), then your program will throw and catch a DayError. To keep things simple, always allow 29 days for February.(If the user enters an illegal month or day other than the valid number, for ex, some gibberish like 8&*68, the program must still print a MonthError/DayError as applicable)
Sample output:

```
Enter Date in month/day numeric notation:
1/30
That is the same as
```

```
January 30
Again?(y/n)
y
Enter Date in month/day numeric notation:
02/29
That is the same as
February 29
Again?(y/n)
y
Enter Date in month/day numeric notation:
02/30
Invalid day for the corresponding month
Try Again!
Enter Date in month/day numeric notation:
1@12/23
Invalid month
Try Again!
Again?(y/n)
y
Enter Date in month/day numeric notation:
1@12&23
Invalid Date
Try Again!
Again?(y/n)
n

End of program
```

Hint: Input each number as a string, and then scan through the string to see if it contains all digits. If not, throw an exception. To convert a string str to an integer, use the following code:
stoi(str); follow: https://www.softwaretestinghelp.com/cpp-string-to-integer/

2. Consider the expression in the form a+b where 'a' and 'b' are numeric values and '+' is any operator. Operators can be +,-,*,/,log and ^.
Write a program to handle these operations and the exceptions generated.
Exceptions that needs to be considered are :
a.Check if 'a' and 'b' are numbers. If yes then ok for further execution else throw an exception and handle it by asking the user to give correct inputs.
b.Check if '+' is an operator as specified in the operators list.
c.Check for the order of the expression as ' a+b' only and not +ab or ab+.
d.Check for divide by zero and log1 exceptions.
Write appropriate catch blocks for handling these exceptions.Make the program a menu driven one to ask the user for the operations to be performed.