LABORATORY ASSIGNMENT

on
Object Oriented Programming (PCC-CS593)

Computer Science & Engineering

5TH Semester

Department of Computer Science & Engineering

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Assignment 1:

1.1 Write a Java program to calculate factorial of an integer number

Test cases:

a) Test Case for a Positive Integer Input:

Input: 5 (positive integer)

Expected Output: 120

b) Test Case for a 0 Input:

Input: 0

Expected Output: 1

c) Test Case for a Negative Number

Input: Input: "-5" (negative integer)

Expected Output: The program should handle negative inputs and provide an appropriate error message.

d) Test Case for a Large Input:

Input: "10" or "20" (large positive integers)

Expected Output: The program should handle large inputs and print correct output.

e) Test Case for Invalid Inputs:

Input: "abc" or "2.5" or "$&^" (non-integer or non-numeric input)

Expected Output: The program should handle invalid inputs and provide an appropriate error message

1.2 Write a Java program to calculate GCD of two integer numbers

Test cases: same as above

1.3 Write a Java program to display prime numbers within a given range.

Test cases: same as above

1.4 Write a Java program to display n Fibonacci terms.

Test cases: same as above

1.5 Write a Java program to calculate sum of n terms of series:

`x^2/2! + x^4/4! + x^6/6! + …….`

Test cases: same as above

Note: All the problems required to solve using function(s) [static or non-static] only.

Assignment 2:

2.1 Write a class program to accept length and breadth as instance variables. Use the following functions for the given purposes:

Class Name — Rectangle

void inputData() — to input length and breadth of a Rectangle

float calculateArea() — to calculate area of a Rectangle

float calculatePerimeter() – to calculate perimeter of a Rectangle

void outputData() — to print area and perimeter of a Rectangle

Use a main method to call the functions.

2.2 Write a program in Java using a class with the following specifications:

Class name: Sort

Data members / instance variables: integer array for 10 numbers.

Member functions:

void arrange(): to display the list of sorted numbers using modified bubble sort.

void search(): to search a given number in the sorted array by using Binary search technique.

2.3 Define a class Employee having the following description:

Data Members	Purpose
int pan	To store personal account number
String name	To store name
double taxincome	To store annual taxable income
double tax	To store tax that is calculated

Member functions	Purpose
void input()	Store the pan number, name, taxable income
void cal()	Calculate tax on taxable income
void display()	Output details of an employee

Calculate tax based on the given conditions and display the output as per the given format.

Total Annual Taxable Income	Tax Rate
Up to ₹2,50,000	No tax
From ₹2,50,001 to ₹5,00,000	10% of the income exceeding ₹2,50,000
From ₹5,00,001 to ₹10,00,000	₹30,000 + 20% of the income exceeding ₹5,00,000
Above ₹10,00,000	₹50,000 + 30% of the income exceeding ₹10,00,000

Output:

Pan Number Name   Tax-Income Tax

……………….   ………… ……

2.4 Question 5: Define a class Discount having the following description:

Data Members	Purpose
int cost	to store the price of an article
String name	to store the customer's name
double dc	to store the discount
double amt	to store the amount to be paid

Member functions	Purpose
void input()	Stores the cost of the article and name of the customer
void cal()	Calculates the discount and amount to be paid
void display()	Displays the name of the customer, cost, discount and amount to be paid

Write a program to compute the discount according to the given conditions and display the output as per the given format.

List Price	Rate of discount
Up to ₹5,000	No discount
From ₹5,001 to ₹10,000	10% on the list price
From ₹10,001 to ₹15,000	15% on the list price
Above ₹15,000	20% on the list price

Output:

Name of the customer Discount   Amount to be paid

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2.5 Define a class Telephone having the following description:

Data Members	Purpose
int prv, pre	to store the previous and present meter readings
int call	to store the calls made (i.e. pre - prv)
String name	to store name of the consumer
double amt	to store the amount
double total	to store the total amount to be paid

Member functions	Purpose
void input()	Stores the previous reading, present reading and name of the consumer
void cal()	Calculates the amount and total amount to be paid
void display()	Displays the name of the consumer, calls made, amount and total amount to be paid

Write a program to compute the monthly bill to be paid according to the given conditions and display the output as per the given format.

Calls made	Rate
Up to 100 calls	No charge
For the next 100 calls	90 paise per call
For the next 200 calls	80 paise per call
More than 400 calls	70 paise per call

However, every consumer has to pay ₹180 per month as monthly rent for availing the service.

Output:

Name of the customer   Calls made Amount to be paid

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Assignment 3:

3.1 Define a class Library having the following description:

Data Members	Purpose
String name	to store name of the book
int price	to store the printed price of the book
int day	to store the number of days for which fine is to be paid
double fine	to store the fine to be paid

Member functions	Purpose
void input()	To accept the name of the book and printed price of the book
void cal()	Calculates the fine to be paid
void display()	Displays the name of the book and fine to be paid

Write a program to compute the fine according to the given conditions and display the fine to be paid.

Days	Fine
First seven days	25 paise per day
Eight to fifteen days	40 paise per day
Sixteen to thirty days	60 paise per day
More than thirty days	80 paise per day

3.2 A bookseller maintains record of books belonging to the various publishers. He uses a class with the specifications given below:

Class name — Stock

Data Members:
1. String title — Contains title of the book
2. String author — Contains author name
3. String pub — Contains publisher's name
4. int noc — Number of copies

Member Methods:
1. void getdata() — To accept title, author, publisher's name and the number of copies.
2. void purchase(int t, String a, String p, int n) — To check the existence of the book in the stock by comparing total, author's and publisher's name. Also check whether noc >n or not. If yes, maintain the balance as noc-n, otherwise display book is not available or stock is under flowing.

Write a program to perform the task given above.

3.3 Bank charges interest for the vehicle loan as given below:

Number of years	Rate of interest
Up to 5 years	15%
More than 5 and up to 10 years	12%
Above 10 years	10%

Write a program to model a class with the specifications given below:

Class name: Loan

Data Members	Purpose
int time	Time for which loan is sanctioned
double principal	Amount sanctioned
double rate	Rate of interest
double interest	To store the interest
double amt	Amount to pay after given time

Member Methods	Purpose
void getdata()	To accept principal and time

void calculate()	To find interest and amount. Interest = (Principal*Rate*Time)/100 Amount = Principal + Interest
void display()	To display interest and amount

3.4 Hero Honda has increased the cost of its vehicles as per the type of the engine using the following criteria:

Type of Engine	Rate of increment
2 stroke	10% of the cost
4 stroke	12% of the cost

Write a program by using a class to find the new cost as per the given specifications:

Class name: Honda

Data Members	Purpose
int type	To accept type of engine 2 stroke or 4 stroke
int cost	To accept previous cost

Member Methods	Purpose
void gettype()	To accept the type of engine and previous cost
void find()	To find the new cost as per the criteria given above
void printcost()	To print the type and new cost of the vehicle

3.5: Define a class called 'Mobike' with the following specifications:

Data Members	Purpose
int bno	To store the bike number
int phno	To store the phone number of the customer
String name	To store the name of the customer
int days	To store the number of days the bike is taken on rent
int charge	To calculate and store the rental charge

Member Methods	Purpose
void input()	To input and store the details of the customer
void compute()	To compute the rental charge
void display()	To display the details in the given format

The rent for a mobike is charged on the following basis:

Days	Charge
For first five days	₹500 per day
For next five days	₹400 per day
Rest of the days	₹200 per day

Output:

Bike No.	Phone No.	Name	No. of days	Charge
xxxxxxx	xxxxxxxx	xxxx	xxx	xxxxxx

Assignment 4:

1. Write a program in Java using a method Discount( ), to calculate a single discount or a successive discount. Use overload methods Discount(int), Discount(int,int) and Discount(int,int,int) to calculate single discount and successive discount respectively. Calculate and display the amount to be paid by the customer after getting discounts on the printed price of an article.

Sample Input:

Printed price: ₹12000

Successive discounts = 10%, 8%

= ₹(12000 - 1200)

= ₹(10800 - 864)

Amount to be paid = ₹9936

2. Write a program in Java to define a class Distance and include following:

        Data members: kilometer, meter, centimeter

        Member functions:

                Distance() – default constructor

                Distance(int,int,int) – parameterized constructor

                Distance(Distance) – copy constructor

                void addDistance(Distance) – to add two distances

                Distance addDistance(Distance) – to add two distances

                void addDistance(Distance,Distance) – to add two distances

3. An electronics shop has announced a special discount on the purchase of Laptops as given below:

Category	Discount on Laptop
Up to ₹25,000	5.0%
₹25,001 - ₹50,000	7.5%
₹50,001 - ₹1,00,000	10.0%
More than ₹1,00,000	15.0%

Define a class Laptop described as follows:

Data members/instance variables:

1. name
2. price
3. dis
4. amt

Member Methods:

1. A parameterized constructor to initialize the data members
2. To accept the details (name of the customer and the price)
3. To compute the discount
4. To display the name, discount and amount to be paid after discount.

Write a main method to create an object of the class and call the member methods.

4. Write a program by using a class with the following specifications:

Class name — Calculate

Instance variables:

1. int num
2. int f
3. int rev

Member Methods:

1. Calculate(int n) — to initialize num with n, f and rev with 0 (zero)
2. int prime() — to return 1, if number is prime
3. int reverse() — to return reverse of the number
4. void display() — to check and print whether the number is a prime palindrome or not

5. The population of a country in a particular year can be calculated by:

$p*(1+r/100)$ at the end of year 2000, where p is the initial population and r is the growth rate. Write a program by using a class to find the population of the country at the end of each year from 2001 to 2007. The Class has the following specifications:

Class name — Population

Data Members — float p, r

Member Methods:

1. Population(int a,int b) — Constructor to initialize p and r with a and b respectively.
2. void print() — to calculate and print the population of each year from 2001 to 2007.

Assignment 5:

5.1 Write a Java program to illustrate the static data member (to store common information for all objects and to generate unique id) and static method (calling using class name).

5.2 Write a program by using class with the following specifications:

Class name — Sale

Data members/ Instance variables:

1. String title, author, publication
2. double price

Member methods:

1. void input() — to accept title, author name and publication name and price of a book
2. void display() — to display title, author name and publication name and price of a book

Now, create another class 'Purchase' that inherits class 'Sale' having the following specifications:

Class name — Purchase

Data members/ Instance variables:

1. int noc
2. int amount;

Member methods:

1. void accept() — to enter the number of copies purchased
2. void calculate( ) — to find the amount by multiplying number of copies ordered and price (i.e., noc * price)

3. void show() — to display the elements describes in base class along with the number of copies purchased and amount to be paid to the shopkeeper

5.3 Write a program to use a class Account with the following specifications:

Class name — Account

Data members — int acno, float balance

Member Methods:

1. Account (int a, int b) — to initialize acno = a, balance = b
2. void withdraw(int w) — to maintain the balance with withdrawal (balance - w)
3. void deposit(int d) — to maintain the balance with the deposit (balance + d)

Use another class Calculate which inherits from class Account with the following specifications:

Data members — int r,t ; float si,amt;

Member Methods:

1. void accept(int x, int y) — to initialize r=x,t=y,amt=0
2. void compute() — to find simple interest and amount
   si = (balance * r * t) / 100;
   a = a + si;
3. void display() — to print account number, balance, interest and amount

5.4 Write java programs to illustrate Single Inheritance, Multilevel Inheritance. Also, write java programs to explain super & method overriding.

5.5 Write a java program to implement runtime polymorphism (e.g., Figure, Rectangle & Triangle).

Assignment 6:

6.1 Write a program in Java to accept a String in upper case and replace all the vowels present in the String with Asterisk (*) sign.
Sample Input: "TATA STEEL IS IN JAMSHEDPUR"
Sample output: T*T* ST**L *S *N J*MSH*DP*R

6.2 Write a program in Java to enter a String/Sentence and display the longest word and the length of the longest word present in the String.
Sample Input: "TATA FOOTBALL ACADEMY WILL PLAY AGAINST MOHAN BAGAN"
Sample Output: The longest word: FOOTBALL: The length of the word: 8

6.3 Write a program in Java to enter a sentence. Display the words which are only palindrome.
Sample Input: MOM AND DAD ARE NOT AT HOME
Sample Output: MOM
                 DAD

6.4 Write a program to accept a sentence. Display the sentence in reversing order of its word.
Sample Input: Computer is Fun
Sample Output: Fun is Computer

6.5 Write a program to input a sentence and display the word of the sentence that contains maximum number of vowels.

Assignment 7:

7.1 A string is said to be 'Unique' if none of the letters present in the string are repeated. Write a program to accept a string and check whether the string is Unique or not. The program displays a message accordingly.

Sample Input: COMPUTER
Sample Output: Unique String

7.2 A 'Happy Word' is defined as:
Take a word and calculate the word's value based on position of the letters in English alphabet. On the basis of word's value, find the sum of the squares of its digits. Repeat the process with the resultant number until the number equals 1 (one). If the number ends with 1 then the word is called a 'Happy Word'.
Write a program to input a word and check whether it a 'Happy Word' or not. The program displays a message accordingly.
Sample Input: VAT
Place value of V = 22, A= 1, T = 20
[Hint: A = 1, B = 2, ----------, Z = 26]
Solution:
$22120 \Rightarrow 2^2 + 2^2 + 1^2 + 2^2 + 0^2 = 13$
$ \Rightarrow 1^2 + 3^2 = 10$
$ \Rightarrow 1^2 + 0^2 = 1$
Sample Output: A Happy Word

7.3 Special words are those words which start and end with the same letter.
Example: EXISTENCE, COMIC, WINDOW
Palindrome words are those words which read the same from left to right and vice-versa.
Example: MALYALAM, MADAM, LEVEL, ROTATOR, CIVIC
All palindromes are special words but all special words are not palindromes.
Write a program to accept a word. Check and display whether the word is a palindrome or only a special word or none of them.

7.4 Write a program to input a sentence. Convert the sentence into upper case letters. Display the words along with frequency of the words which have at least a pair of consecutive letters.
Sample Input: MO**D**EM IS AN ELECTRONIC **DE**VICE
Sample Output:
MO**D**EM
DEVICE
Number of words containing consecutive letters: 2

7.5 Write a program to accept the names of 10 cities in a single dimensional string array and their STD (Subscribers Trunk Dialing) codes in another single dimension integer array. Search for the name of a city input by the user in the list. If found, display "Search Successful" and print the name of the city along with its STD code, or else display the message "Search unsuccessful, no such city in the list".

7.6 Write a program to input a string. Calculate frequency of each character of the string. Also remove the duplicate characters from the string.

Assignment 8:

8.1 Write a java program to illustrate the access protection of private, default, protected & public in java from the same package and different package.

8.2 Write a java program to create a package named mypack, include a class named Shape under this package. Define a method getArea() under the Shape class and overload the getArea() to calculate area of a rectangle, a square and a circle in the same class. Now, import the mypack package from another class named Figure and call the respective method to calculate area of a rectangle, a square and a circle by providing appropriate data.

8.3 Write a java program to create a package named calculation, include a class named Operations under this package. Define two methods sum() and multiply() under the Operations class and overload the sum() and multiply() to calculate sum and product of different data types in the same class. Now, import the calculation package from another class named TwoOperations and call the respective method to calculate sum and product by providing appropriate data.

8.4 Write a java program to create a package named mathcal, include a class named FactGCD under this package. Define two methods calFactorial() and calGCD() under the FactGCD class. Now, create a sub-package of mathcal named mathcheck, include a class named Prime. Define a method isPrime() under the Prime class. Now, import mathcal and mathcheck packages from another class named Calculations and call the respective method by providing appropriate data.

Assignment 9:

9.1 Write a java program to demonstrate multiple catch statements and nested try/catch occurring in a program.

9.2 Write a java program to illustrate usage of try/catch with finally clause.

9.3 Write a java program to describe exception propagation and usage of throws clause.

9.4 Write a java program for creation of user defined exception for the following:

a) To check age of valid voter (only 18 years or above can caste the vote).

b) To check minimum balance of a Bank account during withdrawal of amount (Let minimum balance is Rs. 5000/-)

9.5 Write java programs for:

a) Demonstrating the member inner class.

b) Demonstrating static nested class with instance method and static method.

c) Demonstrating Exception chaining

9.6 Write a java program to implement multiple inheritance using interface.

Assignment 10:

10.1 Write a java program to create a multithreaded program by implementing Runnable interface and then create, initialize, and start two Thread objects from your class. The threads will execute concurrently and display "Java is Hot, Java is Simple", and "Java is Multithreaded" to the console window.

10.2 Write a java program to create two threads by implementing Runnable interface and assign the following tasks:
Thread1 will calculate factorial of n integer numbers and display them.
Thread2 will calculate GCD of n integer numbers and display them.
Apply sleep(1000) to display the result in 1 second interval.

10.3 Write a program to illustrate how the thread priorities works?

10.4 Write a program to illustrates the usage of synchronized method and synchronized statement.

10.5 Write a program to illustrate interthread communication process by implementing Producer and Consumer problem using wait() and notify() methods.

Assignment 11:

11.1 Write a program using swing to implement a simple calculator.

11.2 Write a program to design a form using swing. Include the following to the form:

JFrame, JLebel, JButton, JTextField, JCheckBox, JRadioButton, JComboBox