| Name | Virinchi Sadashiv Shettigar |
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| UID no. | 2021300118 |
| Experiment No. | 7 |

| AIM: | Programs on Abstraction. Implement a program to demonstrate Abstraction using abstract class |
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| **Program 1** | |
|---|---|
| **PROBLEM STATEMENT:** | **Write a program to calculate the percentage of marks obtained in three subjects (each out of 100) by student A and in four subjects (each out of 100) by student B.** <br><br> **Create an abstract class 'Marks' with an abstract method 'getPercentage'.** <br><br> **It is inherited by two other classes 'A' and 'B' each having a method with the same name which returns the percentage of the students.** <br><br> **The constructor of student A takes the marks in three subjects as its parameters and the marks in four subjects as its parameters for student B.** |
| **PROGRAM:** | import java.util.*;<br>abstract class Marks{<br>   abstract double getPercentage();<br><br>}<br>class A extends Marks{<br>    double sub1, percentage;<br>double sub2;<br>double sub3;<br>A(double sub1, double sub2, double sub3) {<br>this.sub1 = sub1;<br>this.sub2 = sub2;<br>this.sub3 = sub3;<br>}<br>double getPercentage() {<br>percentage = (sub1 + sub2 + sub3)/3;<br>return percentage;<br>}<br>}<br>class B extends Marks{<br>double sub1, percentage;<br>double sub2;<br>double sub3;<br>double sub4; |

```java
B(double sub1,double sub2,double sub3,double sub4) {
this.sub1 = sub1;
this.sub2 = sub2;
this.sub3 = sub3;
this.sub4 = sub4;
}
double getPercentage() {
percentage = (sub1 + sub2 + sub3 + sub4)/4;
return percentage;
}
}

public class student{
    public static void main(String[] args){
        Scanner scan=new Scanner(System.in);
        while(true){

            System.out.print("Enter the Student name:\n 1)Student A\n 2) Student B\n");
            int option=scan.nextInt();
            switch(option){
                case 1:
                    System.out.print("Enter marks for 1st subject: ");
                    int A1=scan.nextInt();
                    System.out.print("Enter marks for 2nd subject: ");
                    int A2=scan.nextInt();
                    System.out.print("Enter marks for 3rd subject: ");
                    int A3=scan.nextInt();
                    Marks studentA = new A(A1, A2, A3);
                    double p1 = studentA.getPercentage();
                    System.out.println("Percentage of A : " + p1);
                    break;
                case 2:
                    System.out.print("Enter marks for 1st subject: ");
                    int B1=scan.nextInt();
                    System.out.print("Enter marks for 2nd subject: ");
                    int B2=scan.nextInt();
                    System.out.print("Enter marks for 3rd subject: ");
                    int B3=scan.nextInt();
                    System.out.print("Enter marks for 4th subject: ");
                    int B4=scan.nextInt();
                    Marks studentB = new B(B1, B2, B3, B4);
                    double p2 = studentB.getPercentage();
                    System.out.println("Percentage of B : " + p2);
```

```
                    break;
                default:
                    System.out.print("Invalid option");
            }
            System.out.print("Press '1' to continue or '0' to exit: ");
            int flag=scan.nextInt();
            if(flag==0){
            break;
            }

        }
        }
        }
```

## RESULT:



```
Enter the Student name:
 1)Student A
 2) Student B
1
Enter marks for 1st subject: 90
Enter marks for 2nd subject: 80
Enter marks for 3rd subject: 70
Percentage of A : 80.0
Press '1' to continue or '0' to exit: 1
Enter the Student name:
 1)Student A
 2) Student B
2
Enter marks for 1st subject: 80
Enter marks for 2nd subject: 70
Enter marks for 3rd subject: 77
Enter marks for 4th subject: 90
Percentage of B : 79.25
Press '1' to continue or '0' to exit: 0
```

| Program 2 |
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| **PROBLEM STATEMENT:** | **Define a class Westside that have sales in cloths and accessories. Let us say 10 cloths and 10 accessories each cost is 5000. Cloths and accessories are limited and updated as soon as purchase is done.** |
| | **Define a class named Payment(abstract class) that contains an instance variable of type double that stores the amount of the payment. Amount is initialized 25,000 and updated with each purchase. Also create a method named (abstract)  paymentDetails that updates the amount of the payment.** |
| | **Next, define a  class named CashPayment that is derived from Payment. This class should redefine the paymentDetails method to indicate that the payment is in cash. Include appropriate constructor(s)/methods.** |

| | |
|---|---|
| | **Define a class named CreditCardPayment that is derived from Payment. This class should contain instance variables for the name on the card, expiration date, and credit card number. Include appropriate constructor(s)/methods. Finally, redefine the paymentDetails method to include all credit card information in the printout.**<br><br>**Define a class Person that contains person_name and P_id.**<br><br>**Create a main method that creates at least five persons who will be given random chance for buying using any way of payment method CashPayment /CreditCardPayment. Once person buys cloths/ accessories amount get debited.** |
| **PROGRAM:** | ```java
import java.util.*;
class Westside{
    static int clothes = 10;
    static int accessories = 10;
    void reduce_clothes(int n){
        clothes = clothes-n;
    }
    void reduce_accessories(int m){
        accessories = accessories - m;
    }
}
abstract class Payment{
    abstract void payment_details();
}

class cashpayment extends Payment{
    static int balance;
    cashpayment(){
         balance =25000;
    }
    void reduce_cash(int n){
        balance = balance - n;
    }
    void payment_details(){
        System.out.println("Amount "+(25000-balance) +" Paid in cash, balance : "+this.balance);
    }
    int cash_balance(){
        return balance;
    }
}

class CreditCardPayment extends Payment{
    String cardname;
``` |

```java
    int cardnumber;
    static int balance;
    CreditCardPayment(){
        balance = 25000;
    }
    void get_details(){
        Scanner sc=  new Scanner(System.in);
        System.out.println("Enter Card name:");
        cardname = sc.next();
        System.out.println("Enter card number:");
        cardnumber = sc.nextInt();
    }
    void reduce_card(int n){
        balance = balance - n;
    }
    void payment_details(){
        System.out.println("Amount $"+(25000-balance)+" paid by credit card , Card Name:
"+this.cardname+" Credit Card number: "+this.cardnumber+", balance
remaining :"+this.balance);
    }
    int card_balance(){
        return balance;
    }
}
class Person{
    String name;
    int id;
    void setPerson(){
        Scanner sc=  new Scanner(System.in);
        System.out.println("Enter your name:");
         name = sc.nextLine();
        System.out.println("Enter your id no.:");
         id = sc.nextInt();
    }
    void getperson_details(){
        System.out.println("Name :"+this.name+" , ID :"+this.id);
    }
}
public class Main{
    public static void main(String[] args) {

        Scanner sc=  new Scanner(System.in);
```

```java
Westside w = new Westside();
Person[] p = new Person[5];
CreditCardPayment[] card = new CreditCardPayment[5];
cashpayment[] cash = new cashpayment[5];

int[] check = new int[5];
int r =0,z;
int index;

while(w.clothes != 0 || w.accessories != 0){
    index = (int)(Math.random()*5);
    z=0;
    int po=0;
    for(int i =0 ;i<r;i++){
        if(check[i]==index){
            z++;
        }
    }

    if(r==0){
        check[0]=index;
        r++;
    }

    if(z==0){
        check[r]=index;
        r++;
    }

    System.out.println("clothes remaining =" +w.clothes);
    System.out.println("accessories remaining =" +w.accessories);
    System.out.println("Person : "+(index+1));

    if(z==0){
        card[index] = new CreditCardPayment();
        cash[index] = new cashpayment();
        p[index] =new Person();

        p[index].setPerson();
    }

    System.out.println("Enter no. of clothes u wish to buy");
    int n = sc.nextInt();
```

```java
        System.out.println("Enter no. of accessories u wish to buy");
        int m = sc.nextInt();
        int amount = ((n+m)*(5000));



    if((card[index].card_balance()>=amount ||
cash[index].cash_balance()>=amount)&&(m<=w.clothes && n<=w.accessories)) {

        w.reduce_accessories(m);
        w.reduce_clothes(n);
        System.out.println("Total amount to be paid: $" + amount);
        System.out.println("Press 2 to pay in cash or press 1 to pay using credit card");
        int option = sc.nextInt();
        if (option == 1 && card[index].card_balance()>=amount) {
            System.out.println("Enter Card Details:");
            card[index].get_details();
            card[index].reduce_card(amount);
            p[index].getperson_details();
            card[index].payment_details();
            po++;
        }
        if (option == 2 && cash[index].cash_balance()>=amount) {
            cash[index].reduce_cash(amount);
            p[index].getperson_details();
            cash[index].payment_details();
            po++;
        }
        else if(po==0){
            System.out.println("Transaction failed insufficient Balance");
            w.reduce_accessories(-m);
        w.reduce_clothes(-n);
        }

        else{
            System.out.println("Out of Stock !!");
            w.reduce_accessories(-m);
        w.reduce_clothes(-n);
        }

    }
    else
        System.out.println("Transaction failed insufficient Balance");
}
```

```
                    }
               }
```

**RESULT:**

```
clothes remaining =10
accessories remaining =10
Person : 3
Enter your name:
Viri
Enter your id no.:
23
Enter no. of clothes u wish to buy
1
Enter no. of accessories u wish to buy
1
Total amount to be paid: $10000
Press 2 to pay in cash or press 1 to pay using credit card
2
Name :Viri , ID :23
Amount 10000 Paid in cash, balance : 15000
clothes remaining =9
accessories remaining =9
```

```
Person : 3
Enter no. of clothes u wish to buy
2
Enter no. of accessories u wish to buy
2
Total amount to be paid: $20000
Press 2 to pay in cash or press 1 to pay using credit card
1
Enter Card Details:
Enter Card name:
fdsd
Enter card number:
24567
Name :Viri , ID :23
Amount $20000 paid by credit card , Card Name: fdsd Credit Card number: 24567, balance remaining :5000
Out of Stock !!
clothes remaining =9
accessories remaining =9
Person : 5
```

```
accessories remaining =9
Person : 5
Enter your name:
dev
Enter your id no.:
43
Enter no. of clothes u wish to buy
2
Enter no. of accessories u wish to buy
2
Total amount to be paid: $20000
Press 2 to pay in cash or press 1 to pay using credit card
2
Name :dev , ID :43
Amount 20000 Paid in cash, balance : 5000
clothes remaining =7
accessories remaining =7
Person : 4
Enter your name:
sahil
Enter your id no.:
36
Enter no. of clothes u wish to buy
3
Enter no. of accessories u wish to buy
3
Transaction failed insufficient Balance
clothes remaining =7
accessories remaining =7
Person : 3
Enter no. of clothes u wish to buy
6
Enter no. of accessories u wish to buy
6
Transaction failed insufficient Balance
```

| Program 3 |
|-----------|

| PROBLEM STATEMENT: | There is an abstract class called 'AmusementPark'. |
|---|---|
| | It has a methods |
| | getCost() - Suppose a group comes together so this will return the total cost of the group. |
| | There are 2 classes 'Esselworld' and 'Imagica' that inherit 'AmusementPark'. In EsselWorld, those above 21 age have an entry fee of Rs. 1050 and for ages below 21 or above 60 it's Rs. 660. |
| | Similarly in Imagica, those above 21 age have an entry fee of Rs. 1500 and for ages below 21 or above 60 it's Rs. 1100. |
| | Given:- |

- **Esselworld has a total of 15 games**

- **Imagica has a total of 20 games**

- **Both have some games which are not included in the pass and have some additional cost. (Note: You can assume games are numbered like Game 1 to 15 out of which 7 first 7 games(Game no 1 to 7) are included in the pass and the rest of the games ( game no 8 to 15) have an extra charge of Rs. 50)**

- **When the person is going back home, the total number of games that were played and which were not played must be shown. Also, show the count of the games played.**

- **On weekends Pass cost is Rs 300 higher compared to the actual cost.**

- **Also, display the total cost of the person when he is leaving.(extra game cost+ticket cost)**

| PROGRAM: | |
|---|---|

```java
 import java.util.*;
abstract class Amusement{
   abstract int getCost(int a,int b,int c);
}
class Esselworld extends Amusement{
   int getday(String s){
      if(s.compareTo("sunday")==0 || s.compareTo("saturday")==0 )
         return 300;
      else
         return 0;
   }
   int getage(int a){
      if(a>21 && a<60)
         return 1050;
      else
         return 600;
   }
   int getextra(int n){
      if(n>7) {
         return (n-7) * 50;
      }
      else
         return 0;
   }
   int getCost(int a,int b,int c) {
      return (a+b+c);
```

```java
        }
}

class Imagica extends Amusement{
    int getday(String s){
        if(s.compareTo("sunday")==0 || s.compareTo("saturday")==0)

            return 300;
        else
            return 0;
    }
    int getage(int a){
        if(a>21 && a<60)
            return 1500;
        else
            return 1100;
    }
    int getextra(int n){
        if(n>7) {
            return (n-7) * 50;
        }
        else
            return 0;
    }
    int getCost(int a,int b,int c) {
        return (a+b+c);
    }
}
public class Park{
    public static void main(String[] args) {
        Imagica imagica = new Imagica();
        Esselworld essel = new Esselworld();
        Scanner sc = new Scanner(System.in);
        System.out.println(" Press 1 to book tickets for imagica \nOR\n Press 2 to book tickets for
Esselworld");
        int c = sc.nextInt();
        if(c==1) {
            System.out.println("Hi ! Welcome to Imagica!!\n");
            System.out.println("Enter the day of your visit");
            String day = sc.next();
            System.out.println("Enter the no. of tickets to be booked");
            int num = sc.nextInt();
            int tot=0;
```

```java
        int[][] times = new int[num][15];
        int[] played = new int[num];
        int[] games = new int[num];
        int[] age = new int[num];
        int[][] check = new int[num][15];
        for(int i =0;i<num;i++){
            System.out.println("Enter age of person :"+(i+1));
            age[i]= sc.nextInt();
            sc.nextLine();
            int tell;
            int stop=1;
            while(stop!=0) {
                System.out.println("Which game do u wish to play ");
                tell = sc.nextInt();
                    times[i][tell-1] =times[i][tell-1]+1 ;
                    played[i] = played[i] + 1;
                    if(check[i][tell-1]==0) {
                        games[i] = games[i] + 1;
                        check[i][tell-1]=check[i][tell-1]+1;
                    }
                    sc.nextLine();
                System.out.println("To play more press 1 or press 0 to quit");
                stop= sc.nextInt();
            }
        }
    for(int i =0;i<num;i++){
        System.out.println("\nTicket cost of person "+(i+1)+" =
$"+imagica.getCost(imagica.getage(age[i]),imagica.getday(day),0));
        System.out.println("\nTotal available Games played by person "+(i+1)+" = "+games[i]);
        System.out.println("Total available Games not played by person "+(i+1)+" = "+(20-
games[i]));
        System.out.println("\n");
        for(int j =0;j<15;j++){
            System.out.println("Game no. "+(j+1)+" played "+times[i][j]+" times.");
        }

tot=tot+imagica.getCost(imagica.getage(age[i]),imagica.getday(day),imagica.getextra(played[i]));
        System.out.println("Ticket cost of person + cost of extra games played =
$"+imagica.getCost(imagica.getage(age[i]),imagica.getday(day),imagica.getextra(played[i])));
    }
    System.out.println("\nTotal Ticket cost of Imagica for "+num+" people = $"+tot);
    }
    if(c==2) {
```

```java
System.out.println("Hi ! Welcome to Esselworld!!\n");
System.out.println("Enter the day of your visit:");
String day = sc.next();
System.out.println("Enter the no. of tickets to be booked:");
int num = sc.nextInt();
int tot=0;
int[][] times = new int[num][15];
int[] played = new int[num];
int[] games = new int[num];
int[] age = new int[num];
int[][] check = new int[num][15];
for(int i =0;i<num;i++){
    System.out.println("Enter age of person :"+(i+1));
    age[i]= sc.nextInt();
    sc.nextLine();
    int tell;
    int stop=1;
    while(stop!=0) {
        System.out.println("Which game do u wish to play ");
        tell = sc.nextInt();
        times[i][tell-1] =times[i][tell-1]+1 ;
        played[i] = played[i] + 1;
        if(check[i][tell-1]==0) {
            games[i] = games[i] + 1;
            check[i][tell-1]=check[i][tell-1]+1;
        }
        sc.nextLine();
        System.out.println("To play more press 1 or press 0 to quit");
        stop= sc.nextInt();
    }
}
for(int i =0;i<num;i++){
    System.out.println("\nTicket cost of person "+(i+1)+" =
$"+essel.getCost(essel.getage(age[i]),essel.getday(day),0));
    System.out.println("\nTotal available Games played by person "+(i+1)+" = "+games[i]);
    System.out.println("Total available Games not played by person "+(i+1)+" = "+(15-
games[i]));
    System.out.println("\n");
    for(int j =0;j<15;j++){
        System.out.println("Game no. "+(j+1)+" played "+times[i][j]+" times.");
    }
    tot=
tot+essel.getCost(essel.getage(age[i]),essel.getday(day),essel.getextra(played[i]));
```

```
                System.out.println("Ticket cost of person + cost of extra games played =
        $"+essel.getCost(essel.getage(age[i]),essel.getday(day),essel.getextra(played[i])));
            }
                System.out.println("\nTotal Ticket cost of Esselworld for "+num+" people = $"+tot);
        }
    }
}
```

**RESULT:**

```
 Press 1 to book tickets for imagica
OR
 Press 2 to book tickets for Esselworld
1
Hi ! Welcome to Imagica!!

Enter the day of your visit
Wednesday
Enter the no. of tickets to be booked
3
Enter age of person :1
21
Which game do u wish to play
2
To play more press 1 or press 0 to quit
1
Which game do u wish to play
5
To play more press 1 or press 0 to quit
1
Which game do u wish to play
9
To play more press 1 or press 0 to quit
0
Enter age of person :2
21
Which game do u wish to play
5
To play more press 1 or press 0 to quit
1
Which game do u wish to play
8
```

```
To play more press 1 or press 0 to quit
0
Enter age of person :3
21
Which game do u wish to play
2
To play more press 1 or press 0 to quit
1
Which game do u wish to play
7
To play more press 1 or press 0 to quit
1
Which game do u wish to play
4
To play more press 1 or press 0 to quit
0

Ticket cost of person 1 = $1100

Total available Games played by person 1 = 3
Total available Games not played by person 1 = 17


Game no. 1 played 0 times.
Game no. 2 played 1 times.
Game no. 3 played 0 times.
Game no. 4 played 0 times.
Game no. 5 played 1 times.
Game no. 6 played 0 times.
Game no. 7 played 0 times.
Game no. 8 played 0 times.
Game no. 9 played 1 times.
Game no. 10 played 0 times.
Game no. 11 played 0 times.
Game no. 12 played 0 times.
Game no. 13 played 0 times.
Game no. 14 played 0 times.
Game no. 15 played 0 times.
Ticket cost of person + cost of extra games played = $1100
```

```
Ticket cost of person 2 = $1100

Total available Games played by person 2 = 2
Total available Games not played by person 2 = 18


Game no. 1 played 0 times.
Game no. 2 played 0 times.
Game no. 3 played 0 times.
Game no. 4 played 0 times.
Game no. 5 played 1 times.
Game no. 6 played 0 times.
Game no. 7 played 0 times.
Game no. 8 played 1 times.
Game no. 9 played 0 times.
Game no. 10 played 0 times.
Game no. 11 played 0 times.
Game no. 12 played 0 times.
Game no. 13 played 0 times.
Game no. 14 played 0 times.
Game no. 15 played 0 times.
Ticket cost of person + cost of extra games played = $1100

Ticket cost of person 3 = $1100

Total available Games played by person 3 = 3
Total available Games not played by person 3 = 17


Game no. 1 played 0 times.
Game no. 2 played 1 times.
Game no. 3 played 0 times.
Game no. 4 played 1 times.
Game no. 5 played 0 times.
Game no. 6 played 0 times.
Game no. 7 played 1 times.
Game no. 8 played 0 times.
Game no. 9 played 0 times.
Game no. 10 played 0 times.
Game no. 11 played 0 times.
Game no. 12 played 0 times.
Game no. 13 played 0 times.
Game no. 14 played 0 times.
Game no. 15 played 0 times.
Ticket cost of person + cost of extra games played = $1100

Total Ticket cost of Imagica for 3 people = $3300
```

| | |
|---|---|
| **CONCLUSION:** | In this experiment, we learned about the basic meaning of abstract classes and methods and how they can be declared and their implementation. |