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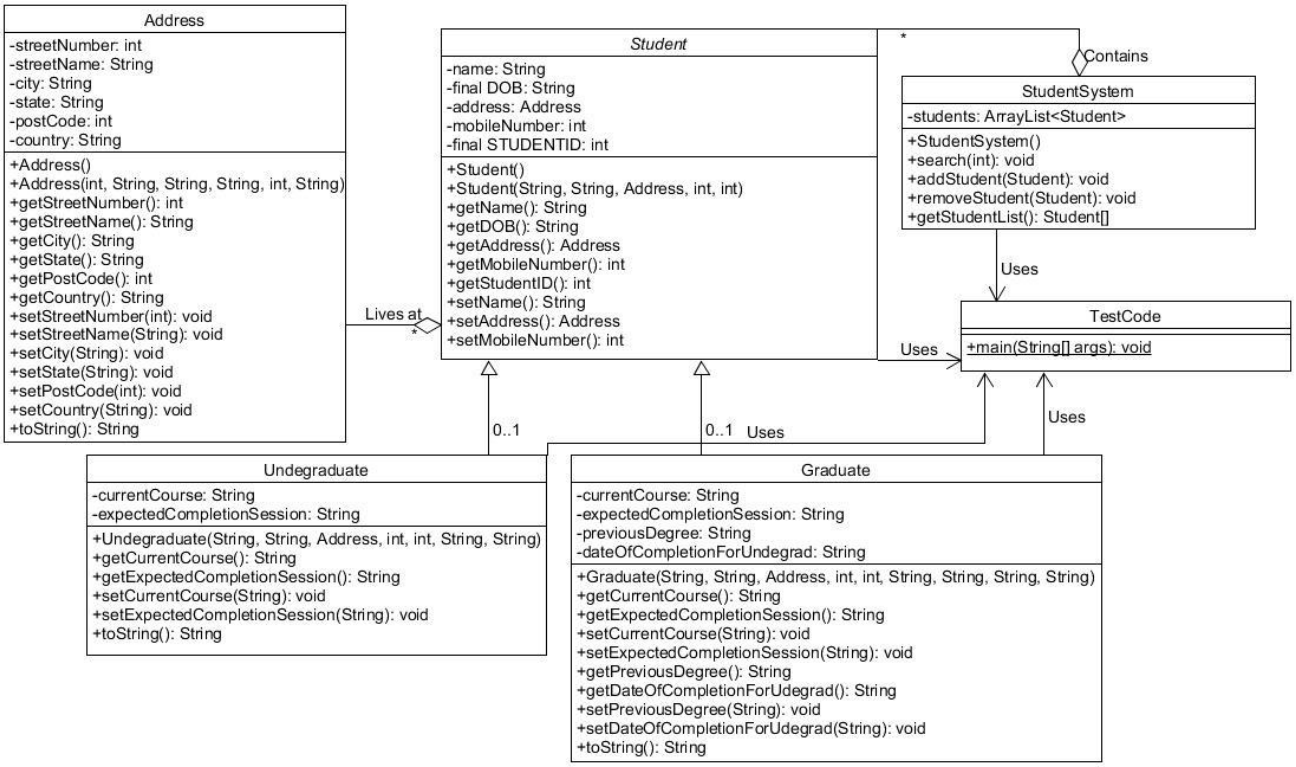
TASK 1:

UML CLASS DIAGRAM:



SOURCE CODE:

```
import java.util.Scanner;
import java.util.ArrayList;
import java.util.List;

class TestCode{
    public static void main(String[] args){
        //create studentSystem object
        StudentSystem studentSystem = new StudentSystem();

        //create one undergraduate student and one postgraduate student
        Address home = new Address(26, "Random street", "City of monkeys", "Tasmania", 1234,
"Australia");
        Student student1 = new Graduate("James", "14/08/2000", home, 423628825, 100000, "Masters in
electrical engineering", "Winter, 2023", "Bachelor of Medical Science", "03/12/2019");
        Student student2 = new Undergraduate("Sean", "30/09/1998", home, 42782627, 200000, "Bachelor
of Computer Science", "Spring, 2023");

        //add the two student objects to the student arraylist;
        studentSystem.addStudent(student1);
        studentSystem.addStudent(student2);

        //student search method to search and print two students info
        Scanner input = new Scanner(System.in);
```

```
        System.out.println("Enter a student ID to search for: ");
        studentSystem.search(Integer.parseInt(input.nextLine()));

        System.out.println("Enter a student ID to search for: ");
        studentSystem.search(Integer.parseInt(input.nextLine()));

        /*use a for loop to go through the student arraylist and
        update the undergraduate student's expected completion
        session to "Spring 2022", and update the postgraduate student's
        previous degree to "Bachelor of Math"(using instanceof and
        downcasting)*/

        //need to convert arraylist to normal array
        Student[] students = studentSystem.getStudentList();

        for(Student student : students){
            if(student instanceof Undergraduate){
                //downcasting
                Undergraduate undergrad = (Undergraduate)student;
                undergrad.setExpectedCompletionSession("Spring 2022");
            }
            else if(student instanceof Graduate){
                //downcasting
                Graduate grad = (Graduate)student;
                grad.setPreviousDegree("Bachelor of Math");
            }
        }

        /*use another for loop to print the updated information of
        the two students*/
        System.out.println();
        System.out.println("After changes have been made:");

        for(Student student : students){
            System.out.println();
            System.out.println(student);
        }
    }
}

class Address{
    //datafields
    private int streetNumber;
    private String streetName;
    private String city;
    private String state;
    private int postCode;
    private String country;

    //constructors
    /*should always have default constructor especially in case of
    future inheritance*/
    public Address(){
        //all datafields need to be initialised otherwise error occurs
        this.streetNumber = 0;
```

```
        this.streetName = "x";
        this.city = "x";
        this.state = "x";
        this.postCode = 0;
        this.country = "x";
    }

    public Address(int streetNumber, String streetName,
                   String city, String state, int postCode,
                   String country){
        this.streetNumber = streetNumber;
        this.streetName = streetName;
        this.city = city;
        this.state = state;
        this.postCode = postCode;
        this.country = country;
    }

    //methods
    public int getStreetNumber(){
        return streetNumber;
    }

    public String getStreetName(){
        return streetName;
    }

    public String getCity(){
        return city;
    }

    public String getState(){
        return state;
    }

    public int getPostCode(){
        return postCode;
    }

    public String getCountry(){
        return country;
    }

    public void setStreetNumber(int streetNumber){
        this.streetNumber = streetNumber;
    }

    public void setStreetName(String streetName){
        this.streetName = streetName;
    }

    public void setCity(String city){
        this.city = city;
    }
```

```
    public void setState(String state){
        this.state = state;
    }

    public void setPostCode(int postCode){
        this.postCode = postCode;
    }

    public void setCountry(String country){
        this.country = country;
    }

    @Override
    public String toString(){
        return Integer.toString(getStreetNumber()) + " " + getStreetName() + ", " + getCity() + ", " +
getState() + ", " + getCountry() + ", " + getPostCode();
    }
}

class StudentSystem{
    //datafields
    private ArrayList<Student> students;

    //constructor
    public StudentSystem(){
        this.students = new ArrayList<Student>();
    }

    //methods
    public void search(int STUDENTID){
        //loop through students find a match and print
        boolean studentFound = false;

        for(int i = 0; i < students.size(); i++){
            Student student = students.get(i);
            if(student.getStudentID() == STUDENTID){
                studentFound = true;
                System.out.println();
                System.out.println("Student found:");
                System.out.println(student);
            }
        }
        if(!studentFound){
            System.out.println();
            System.out.println("No student found.");
        }
    }

    public void addStudent(Student student){
        students.add(student);
    }

    public void removeStudent(Student student){
        students.remove(student);
    }
```

```
    public Student[] getStudentList(){
        //using list interface
        List<Student> studentsList = students;
        Student[] studentsArray = new Student[studentsList.size()];
        studentsArray = studentsList.toArray(studentsArray);
        return studentsArray;
    }
}

abstract class Student{
    //datafields
    private String name;
    private final String DOB;
    private Address address;
    private double mobileNumber;
    private final int STUDENTID;

    //constructors
    public Student(){
        this.name = "x";
        this.DOB = "x";
        this.address = new Address();
        this.mobileNumber = 0;
        this.STUDENTID = 0;
    }

    public Student(String name, String DOB, Address address, double mobileNumber, int STUDENTID){
        this.name = name;
        this.DOB = DOB;
        this.address = address;
        this.mobileNumber = mobileNumber;
        this.STUDENTID = STUDENTID;
    }

    //methods
    public String getName(){
        return name;
    }

    public String getDOB(){
        return DOB;
    }

    public Address getAddress(){
        return address;
    }

    public double getMobileNumber(){
        return mobileNumber;
    }

    public int getStudentID(){
        return STUDENTID;
    }
```

```
    public void setName(String name){
        this.name = name;
    }

    public void setAddress(Address address){
        this.address = address;
    }

    public void setMobileNumber(double number){
        this.mobileNumber = number;
    }
}

class Undergraduate extends Student{
    //datafields
    private String currentCourse;
    private String expectedCompletionSession;

    //constructors
    public Undergraduate(){
        super();
        this.currentCourse = "x";
        this.expectedCompletionSession ="x";
    }

    public Undergraduate(String name, String DOB, Address address, double mobileNumber, int STUDENTID,
String currentCourse, String expectedCompletionSession){
        super(name, DOB, address, mobileNumber, STUDENTID);
        this.currentCourse = currentCourse;
        this.expectedCompletionSession = expectedCompletionSession;
    }

    //methods
    public String getCurrentCourse(){
        return currentCourse;
    }

    public String getExpectedCompletionSession(){
        return expectedCompletionSession;
    }

    public void setCurrentCourse(String currentCourse){
        this.currentCourse = currentCourse;
    }

    public void setExpectedCompletionSession(String expectedCompletionSession){
        this.expectedCompletionSession = expectedCompletionSession;
    }

    @Override
    public String toString(){
        return String.format("%s enrolled in %s. \n DOB: %s \n Mobile: %.0f \n Address: %s \n Student
ID: %s \n Expected Completion session: %s",
```

```
        super.getName(), getCurrentCourse(), super.getDOB(), super.getMobileNumber(),
super.getAddress(), super.getStudentID(), getExpectedCompletionSession());
    }
}

class Graduate extends Student{
    //datafields
    private String currentCourse;
    private String expectedCompletionSession;
    private String previousDegree;
    private String dateOfCompletionForUndergrad;

    //constructors
    public Graduate(){
        super();
        this.currentCourse = "x";
        this.expectedCompletionSession = "x";
        this.previousDegree = "x";
        this.dateOfCompletionForUndergrad = "x";
    }

    public Graduate(String name, String DOB, Address address, double mobileNumber, int STUDENTID,
String currentCourse, String expectedCompletionSession, String previousDegree, String
dateOfCompletionForUndergrad){
        super(name, DOB, address, mobileNumber, STUDENTID);
        this.currentCourse = currentCourse;
        this.expectedCompletionSession = currentCourse;
        this.previousDegree = previousDegree;
        this.dateOfCompletionForUndergrad = dateOfCompletionForUndergrad;
    }

    //methods
    public String getCurrentCourse(){
        return currentCourse;
    }

    public String getExpectedCompletionSession(){
        return expectedCompletionSession;
    }

    public void setCurrentCourse(String currentCourse){
        this.currentCourse = currentCourse;
    }

    public void setExpectedCompletionSession(String expectedCompletionSession){
        this.expectedCompletionSession = expectedCompletionSession;
    }

    public String getPreviousDegree(){
        return previousDegree;
    }

    public String getDateOfCompletionForUndergrad(){
        return dateOfCompletionForUndergrad;
    }
```

```java
    public void setPreviousDegree(String previousDegree){
        this.previousDegree = previousDegree;
    }

    public void setDateOfCompletionForUndegrad(String dateOfCompletionForUndergrad){
        this.dateOfCompletionForUndergrad = dateOfCompletionForUndergrad;
    }

    @Override
    public String toString(){
        return String.format("%s currently enrolled in %s. \n DOB: %s \n Mobile: %.0f \n Address: %s
\n Student ID: %s \n Expected Completion session: %s \n Undergraduate degree: %s (completed on %s)",
        super.getName(), getCurrentCourse(), super.getDOB(),
        super.getMobileNumber(), super.getAddress(),
        super.getStudentID(), getExpectedCompletionSession(),
        getPreviousDegree(), getDateOfCompletionForUndergrad());
    }
}
```

SNAPSHOTS FOR SUCCESSFUL COMPILATION AND TESTING (as specified):

```
C:\Users\Sean\Documents\CSI121 OOP\Labs\Lab3\Task1>javac TestCode.java

C:\Users\Sean\Documents\CSI121 OOP\Labs\Lab3\Task1>java TestCode
Enter a student ID to search for:
100000

Student found:
James currently enrolled in Masters in electrical engineering.
 DOB: 14/08/2000
 Mobile: 423628825
 Address: 26 Random street, City of monkeys, Tasmania, Australia, 1234
 Student ID: 100000
 Expected Completion session: Masters in electrical engineering
 Undergraduate degree: Bachelor of Medical Science (completed on 03/12/2019)
Enter a student ID to search for:
200000

Student found:
Sean enrolled in Bachelor of Computer Science.
 DOB: 30/09/1998
 Mobile: 42782627
 Address: 26 Random street, City of monkeys, Tasmania, Australia, 1234
 Student ID: 200000
 Expected Completion session: Spring, 2023
```

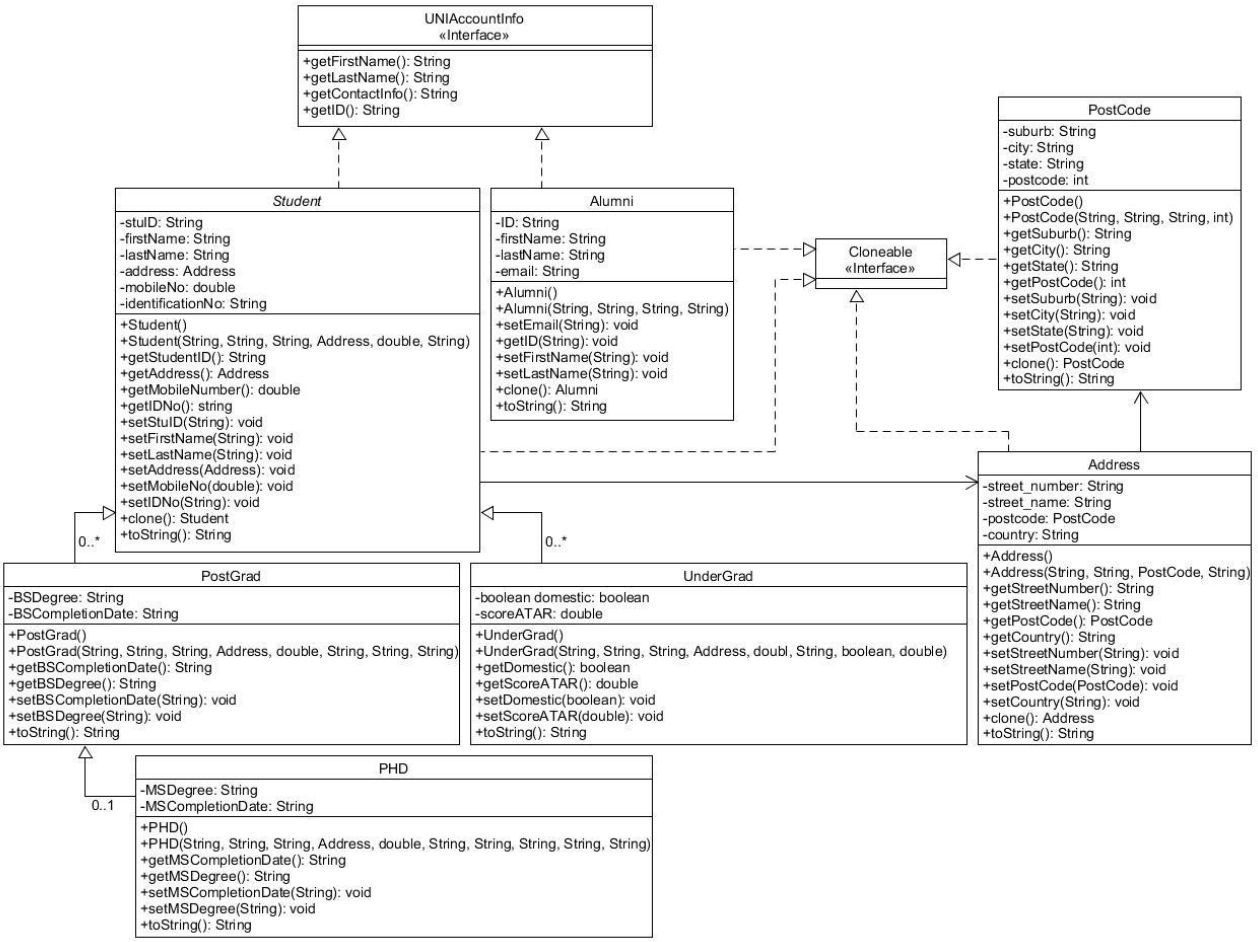
```
After changes have been made:

James currently enrolled in Masters in electrical engineering.
 DOB: 14/08/2000
 Mobile: 423628825
 Address: 26 Random street, City of monkeys, Tasmania, Australia, 1234
 Student ID: 100000
 Expected Completion session: Masters in electrical engineering
 Undergraduate degree: Bachelor of Math (completed on 03/12/2019)

Sean enrolled in Bachelor of Computer Science.
 DOB: 30/09/1998
 Mobile: 42782627
 Address: 26 Random street, City of monkeys, Tasmania, Australia, 1234
 Student ID: 200000
 Expected Completion session: Spring 2022
```

TASK2:

UML CLASS DIAGRAM:



SOURCE CODE:

```
class TestCode{
```

```
    public static void main(String[] args) throws CloneNotSupportedException{
        //create PHD object and Undergraduate object
        PostCode postcode = new PostCode("Figtree", "Wollongong", "NSW", 2527);
        Address address = new Address("47", "Georgia Street", postcode, "Australia");
        PHD phdStudent = new PHD("89764523", "Jake", "Rake",
    address, 42678123, "8793223", "Bachelor of Computer Science", "12/12/2015",
    "Masters in Electrical Engineering", "12/12/2018");
        UnderGrad undergradStudent = new UnderGrad("1234567", "John", "Smith", address,
        42356728, "12345687", true, 93.3);

        System.out.println("PHD Student: ");
        System.out.println(phdStudent);
        System.out.println();
        System.out.println("Undegrad Student: ");
        System.out.println(undergradStudent);

        //test deep clone methods of each
        Student phdStudentClone = phdStudent.clone();
        Student undergradStudentClone = undergradStudent.clone();

        System.out.println();
        System.out.println("New clones:");
        System.out.println("PHD Student: ");
        System.out.println(phdStudentClone);
        System.out.println();
        System.out.println("Undegrad Student: ");
        System.out.println(undergradStudentClone);

        //making changes to original objects
        address.setStreetNumber("798");
        address.setStreetName("Melon Drive");
        address.setCountry("New Zealand");
        postcode.setPostCode(1234);

        //printing original object with changes vs new clone with no changes
        System.out.println();
        System.out.println("Original object vs clone after changes to address object:");
        System.out.println("PHD Student: ");
        System.out.println(phdStudent);
        System.out.println();
        System.out.println("PHD Student clone: ");
        System.out.println(phdStudentClone);
        System.out.println();
        System.out.println("Undegrad Student: ");
        System.out.println(undergradStudent);
        System.out.println();
        System.out.println("Undergrad clone: ");
        System.out.println(undergradStudentClone);

        System.out.println();
        System.out.println("That is, the clone has been deep cloned so \nchanges to original address
and postcode objects do not \naffect deep clone.");
    }
}
```

```java
interface UNIAccountInfo{
    //empty methods
    public String getFirstName();
    public String getLastName();
    public String getContactInfo();
    public String getID();
}

class Alumni implements UNIAccountInfo{
    //data-fields
    private String ID;
    private String firstName;
    private String lastName;
    private String email;

    //constructors
    public Alumni(){
        this.ID = " ";
        this.firstName = " ";
        this.lastName = " ";
        this.email = " ";
    }

    public Alumni(String ID, String firstName, String lastName, String email){
        this.ID = ID;
        this.firstName = firstName;
        this.lastName = lastName;
        this.email = email;
    }

    //methods
    public String getFirstName(){
        return firstName;
    }

    public String getLastName(){
        return lastName;
    }

    public String getContactInfo(){
        return "Email: " + email;
    }

    public String getID(){
        return ID;
    }

    public void setEmail(String email){
        this.email = email;
    }

    public void setID(String ID){
        this.ID = ID;
    }
```

```
    public void setFirstName(String firstName){
        this.firstName = firstName;
    }

    public void setLastName(String lastName){
        this.lastName = lastName;
    }

    @Override
    public Alumni clone() throws CloneNotSupportedException{
        return (Alumni)super.clone();
    }

    @Override
    public String toString(){
        return String.format("ID: %s \n First name: %s \n Last name: %s \n %s", getID(),
getFirstName(), getLastName(), getContactInfo());
    }
}

class Address implements Cloneable{
    //datafields
    private String street_number;
    private String street_name;
    private PostCode postcode;
    private String country;

    //default constructor
    public Address(){
        this.street_number = "0";
        this.street_name = " ";
        this.postcode = new PostCode();
        this.country = " ";
    }

    //parameterised constructor
    public Address(String street_number, String street_name, PostCode postcode, String country){
        this.street_number = street_number;
        this.street_name = street_name;
        this.postcode = postcode;
        this.country = country;
    }

    public String getStreetNumber(){
        return street_number;
    }

    public String getStreetName(){
        return street_name;
    }

    public PostCode getPostCode(){
        return postcode;
    }
```

```
    public String getCountry(){
        return country;
    }

    public void setStreetNumber(String street_number){
        this.street_number = street_number;
    }

    public void setStreetName(String street_name){
        this.street_name = street_name;
    }

    public void setPostCode(PostCode postCode){
        this.postcode = postCode;
    }

    public void setCountry(String country){
        this.country = country;
    }

    //deep clone
    @Override
    public Address clone() throws CloneNotSupportedException{
        //shallow clone
        Address newAddressObj = (Address) super.clone();

        //making it a deep clone by cloning objects within object Address
        newAddressObj.setPostCode((PostCode)this.getPostCode().clone());

        return newAddressObj;
    }

    //methods
    @Override
    public String toString(){
        return String.format("Address: %s %s, %s, %s", getStreetNumber(),
        getStreetName(), getPostCode(), getCountry());
    }
}

class PostCode implements Cloneable{
    //datafields
    private String suburb;
    private String city;
    private String state;
    private int postcode;

    //default constructor
    public PostCode(){
        this.suburb = " ";
        this.city = " ";
        this.state = " ";
        this.postcode = 0;
    }
```

```
    //parameterised constructor
    public PostCode(String suburb, String city, String state, int postcode){
        this.suburb = suburb;
        this.city = city;
        this.state = state;
        this.postcode = postcode;
    }

    //methods
    public String getSuburb(){
        return suburb;
    }

    public String getCity(){
        return city;
    }

    public String getState(){
        return state;
    }

    public int getPostCode(){
        return postcode;
    }

    public void setSuburb(String suburb){
        this.suburb = suburb;
    }

    public void setCity(String city){
        this.city = city;
    }

    public void setState(String state){
        this.state = state;
    }

    public void setPostCode(int postcode){
        this.postcode = postcode;
    }

    //implementing cloneable interface
    @Override
    public PostCode clone() throws CloneNotSupportedException{
        return (PostCode) super.clone();
    }

    @Override
    public String toString(){
        return Integer.toString(getPostCode());
    }
}

abstract class Student implements UNIAccountInfo, Cloneable{
    //datafields
```

```
    private String stuID;
    private String firstName;
    private String lastName;
    private Address address;
    private double mobileNo;
    private String identificationNo;

    //default constructor
    public Student(){
        this.stuID = " ";
        this.firstName = " ";
        this.lastName = " ";
        this.address = new Address();
        this.mobileNo = 0;
        this.identificationNo = "0";
    }

    //paramterised constructor
    public Student(String stuID, String firstName, String lastName, Address address, double mobileNo,
String identificationNo){
        this.stuID = stuID;
        this.firstName = firstName;
        this.lastName = lastName;
        this.address = address;
        this.mobileNo = mobileNo;
        this.identificationNo = identificationNo;
    }

    //methods
    //UNIAccountInfo implementation
    public String getFirstName(){
        return firstName;
    }

    public String getLastName(){
        return lastName;
    }

    public String getContactInfo(){
        return String.format("Mobile number: %.0f", getMobileNumber());
    }

    public String getID(){
        return "Student ID: " + getStudentID() + "\nIdentification Number: " + getIDNo();
    }

    //Cloneable implementation
    @Override
    public Student clone() throws CloneNotSupportedException {
        Student studentClone = (Student) super.clone();
        studentClone.setAddress((Address)this.getAddress().clone());
        return studentClone;
    }

    //get/set methods
```

```
    public String getStudentID(){
        return stuID;
    }

    public Address getAddress(){
        return address;
    }

    public double getMobileNumber(){
        return mobileNo;
    }

    public void setStuID(String stuID){
        this.stuID = stuID;
    }

    public void setFirstName(String firstName){
        this.firstName = firstName;
    }

    public void setLastName(String lastName){
        this.lastName = lastName;
    }

    public void setAddress(Address address){
        this.address = address;
    }

    public void setMobileNo(double mobileNo){
        this.mobileNo = mobileNo;
    }

    public void setIDNo(String identificationNo){
        this.identificationNo = identificationNo;
    }

    public String getIDNo(){
        return identificationNo;
    }

    @Override
    public String toString(){
        return String.format("Student ID: %s \n%s %s \n%s \n%s",
         getStudentID(), getFirstName(), getLastName(),
         getAddress(), getContactInfo());
    }
}

class PostGrad extends Student{
    //datafields
    //should date be a Data object
    private String BSDegree;
    private String BSCompletionDate;

    //dedault constructor
```

```
    public PostGrad(){
        super();
        this.BSDegree = " ";
        this.BSCompletionDate = " ";
    }

    //parameterised constructor
    public PostGrad(String stuID, String firstName, String lastName,
    Address address, double mobileNo, String identificationNo,
    String BSDegree, String BSCompletionDate){
        super(stuID, firstName, lastName, address, mobileNo, identificationNo);
        this.BSDegree = BSDegree;
        this.BSCompletionDate = BSCompletionDate;
    }

    public String getBSCompletionDate(){
        return BSCompletionDate;
    }

    public String getBSDegree(){
        return BSDegree;
    }

    public void setBSCompletionDate(String BSCompletionDate){
        this.BSCompletionDate = BSCompletionDate;
    }

    public void setBSDegree(String BSDegree){
        this.BSDegree = BSDegree;
    }

    public String toString(){
        return super.toString() + "\n"
        + String.format("Bachelor degree: %s\nCompletion Date: %s",
        getBSDegree(), getBSCompletionDate());
    }
}

class UnderGrad extends Student{
    //datafields
    private boolean domestic;
    private double scoreATAR;

    //default constructor
    public UnderGrad(){
        super();
        this.domestic = true;
        this.scoreATAR = 0;
    }

    //parameterised constructor
    public UnderGrad(String stuID, String firstName, String lastName,
    Address address, double mobileNo, String identificationNo,
    boolean domestic, double scoreATAR){
        super(stuID, firstName, lastName, address, mobileNo, identificationNo);
```

```
        this.domestic = domestic;
        this.scoreATAR = scoreATAR;
    }

    public boolean getDomestic(){
        return domestic;
    }

    public double getScoreATAR(){
        return scoreATAR;
    }

    public void setDomestic(boolean domestic){
        this.domestic = domestic;
    }

    public void setScoreATAR(double atar){
        this.scoreATAR = atar;
    }

    public String toString(){
        return super.toString() + "\n"
        + String.format("ATAR: %s\nDomestic: %b",
        getScoreATAR(), getDomestic());
    }
}

class PHD extends PostGrad{
    //datafields
    private String MSDegree;
    private String MSCompletionDate;

    //default constructor
    public PHD(){
        super();
        this.MSDegree = " ";
        this.MSCompletionDate = " ";
    }

    //paramterised constructor
    public PHD(String stuID, String firstName, String lastName,
    Address address, double mobileNo, String identificationNo,
    String BSDegree, String BSCompletionDate,
    String MSDegree, String MSCompletionDate){
        super(stuID, firstName, lastName, address, mobileNo, identificationNo, BSDegree,
BSCompletionDate);
        this.MSDegree = MSDegree;
        this.MSCompletionDate = MSCompletionDate;
    }

    //methods
    public String getMSDegree(){
        return MSDegree;
    }
```

```
    public String getMSCompletionDate(){
        return MSCompletionDate;
    }

    public void setMSDegree(String MSDegree){
        this.MSDegree = MSDegree;
    }

    public void setMSCompletionDate(String MSCompletionDate){
        this.MSCompletionDate = MSCompletionDate;
    }

    public String toString(){
        return super.toString() + "\n"
        + String.format("MS Degree: %s \nCompletion date: %s",
        getMSDegree(), getMSCompletionDate());
    }
}
```

SNAPSHOTS FOR SUCCESSFUL COMPILATION AND TESTING:

```
C:\Users\Sean\Documents\CSI121 OOP\Labs\Lab3\Task2>javac TestCode.java

C:\Users\Sean\Documents\CSI121 OOP\Labs\Lab3\Task2>java TestCode
PHD Student:
Student ID: 89764523
Jake Rake
Address: 47 Georgia Street, 2527, Australia
Mobile number: 42678123
Bachelor degree: Bachelor of Computer Science
Completion Date: 12/12/2015
MS Degree: Masters in Electrical Engineering
Completion date: 12/12/2018

Undegrad Student:
Student ID: 1234567
John Smith
Address: 47 Georgia Street, 2527, Australia
Mobile number: 42356728
ATAR: 93.3
Domestic: true
```

```
New clones:
PHD Student:
Student ID: 89764523
Jake Rake
Address: 47 Georgia Street, 2527, Australia
Mobile number: 42678123
Bachelor degree: Bachelor of Computer Science
Completion Date: 12/12/2015
MS Degree: Masters in Electrical Engineering
Completion date: 12/12/2018

Undegrad Student:
Student ID: 1234567
John Smith
Address: 47 Georgia Street, 2527, Australia
Mobile number: 42356728
ATAR: 93.3
Domestic: true
```

```
Original object vs clone after changes to address object:
PHD Student:
Student ID: 89764523
Jake Rake
Address: 798 Melon Drive, 1234, New Zealand
Mobile number: 42678123
Bachelor degree: Bachelor of Computer Science
Completion Date: 12/12/2015
MS Degree: Masters in Electrical Engineering
Completion date: 12/12/2018

PHD Student clone:
Student ID: 89764523
Jake Rake
Address: 47 Georgia Street, 2527, Australia
Mobile number: 42678123
Bachelor degree: Bachelor of Computer Science
Completion Date: 12/12/2015
MS Degree: Masters in Electrical Engineering
Completion date: 12/12/2018
```

```
Undegrad Student:
Student ID: 1234567
John Smith
Address: 798 Melon Drive, 1234, New Zealand
Mobile number: 42356728
ATAR: 93.3
Domestic: true

Undergrad clone:
Student ID: 1234567
John Smith
Address: 47 Georgia Street, 2527, Australia
Mobile number: 42356728
ATAR: 93.3
Domestic: true

That is, the clone has been deep cloned so
changes to original address and postcode objects do not
affect deep clone.
```