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/****** DbObject.java *****/
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```
import java.io.*;
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```
abstract class DbObject {  
    java.util.Scanner kb = new java.util.Scanner(System.in);  
    public void writeString(String s, RandomAccessFile out) throws IOException {  
        for (int i = 0; i < s.length(); i++)  
            out.writeChar(s.charAt(i));  
    }  
    public String readString(int len, RandomAccessFile in) throws IOException {  
        StringBuffer s = new StringBuffer(len);  
        for (int i = 0; i < len; i++)  
            s.append(in.readChar());  
        return s.toString();  
    }  
    abstract public void writeToFile(RandomAccessFile out) throws IOException;  
    abstract public void readFromFile(RandomAccessFile in) throws IOException;  
    abstract public void readFromConsole();  
    abstract public void writeLegibly();  
    abstract public void readKey();  
    abstract public void copy(DbObject[] db);  
    abstract public int size();  
}
```

```
/****** Personal.java *****/
```

```
import java.io.*;
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```

public class Personal extends DbObject {
    protected final int nameLen = 10, cityLen = 10;
    protected String name, city;
    protected int SSN, year;
    protected long salary;
    protected final int size = 4 + nameLen*2 + cityLen*2 + 4 + 8;
    Personal() {
    }
    Personal(int ssn, String n, String c, int y, long s) {
        SSN = ssn; name = n; city = c; year = y; salary = s;
    }
    public int size() {
        return size;
    }
    public boolean equals(Object pr) {
        return SSN == ((Personal)pr).SSN;
    }
    public void writeToFile(RandomAccessFile out) throws IOException {
        out.writeInt(SSN);
        writeString(name,out);
        writeString(city,out);
        out.writeInt(year);
        out.writeLong(salary);
    }
    public void writeLegibly() {
        System.out.print("SSN = " + SSN + ", name = " + name.trim() + ", city = " + city.trim() + ", year = " + year + ",
            salary = " + salary);
    }
    public void readFromFile(RandomAccessFile in) throws IOException {
        SSN = in.readInt();

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        name = readString(nameLen,in);
        city = readString(cityLen,in);
        year = in.readInt();
        salary = in.readLong();
    }
    public void readKey() {
        System.out.print("Enter SSN: ");
        SSN = kb.nextInt();
    }
    public void readFromConsole() {
        System.out.print("Enter SSN: ");
        SSN = kb.nextInt();
        System.out.print("Name: ");
        name = kb.next();
        for (int i = name.length(); i < nameLen; i++)
            name += ' ';
        System.out.print("City: ");
        city = kb.next();
        for (int i = city.length(); i < cityLen; i++)
            city += ' ';
        System.out.print("Birthyear: ");
        year = kb.nextInt();
        System.out.print("Salary: ");
        salary = kb.nextLong();
    }
    public void copy(DbObject[] d) {
        d[0] = new Personal(SSN,name,city,year,salary);
    }
}

```

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/****** Student.java *****/
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```
import java.io.*;
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```
public class Student extends Personal {  
    public int size() {  
        return super.size() + majorLen*2;  
    }  
    protected String major;  
    protected final int majorLen = 10;  
    Student() {  
        super();  
    }  
    Student(int ssn, String n, String c, int y, long s, String m) {  
        super(ssn,n,c,y,s);  
        major = m;  
    }  
    public void writeToFile(RandomAccessFile out) throws IOException {  
        super.writeToFile(out);  
        writeString(major,out);  
    }  
    public void readFromFile(RandomAccessFile in) throws IOException {  
        super.readFromFile(in);  
        major = readString(majorLen,in);  
    }  
    public void readFromConsole() {  
        super.readFromConsole();  
        System.out.print("Enter major: ");  
        major = kb.next();  
        for (int i = major.length(); i < nameLen; i++)
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        major += ' ';
    }
    public void writeLegibly() {
        super.writeLegibly();
        System.out.print(", major = " + major.trim());
    }
    public void copy(DbObject[] d) {
        d[0] = new Student(SSN,name,city,year,salary,major);
    }
}

/***** Database.java *****/

import java.io.*;

public class Database {
    private RandomAccessFile database;
    private String fName = new String();
    java.util.Scanner kb = new java.util.Scanner(System.in);
    Database() {
    }
    private void add(DbObject d) throws IOException {
        database = new RandomAccessFile(fName,"rw");
        database.seek(database.length());
        d.writeToFile(database);
        database.close();
    }
    private void modify(DbObject d) throws IOException {
        DbObject[] tmp = new DbObject[1];
        d.copy(tmp);
    }
}

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        database = new RandomAccessFile(fName,"rw");
        while (database.getFilePointer() < database.length()) {
            tmp[0].readFromFile(database);
            if (tmp[0].equals(d)) {
                tmp[0].readFromConsole();
                database.seek(database.getFilePointer()-d.size());
                tmp[0].writeToFile(database);
                database.close();
                return;
            }
        }
        database.close();
        System.out.println("The record to be modified is not in the database");
    }

    private boolean find(DbObject d) throws IOException {
        DbObject[] tmp = new DbObject[1];
        d.copy(tmp);
        database = new RandomAccessFile(fName,"r");
        while (database.getFilePointer() < database.length()) {
            tmp[0].readFromFile(database);
            if (tmp[0].equals(d)) {
                database.close();
                return true;
            }
        }
        database.close();
        return false;
    }

    private void printDb(DbObject d) throws IOException {
        database = new RandomAccessFile(fName,"r");
    }

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        while (database.getFilePointer() < database.length()) {
            d.readFromFile(database);
            d.writeLegibly();
            System.out.println();
        }
        database.close();
    }
}

public void run(DbObject rec) throws IOException {
    String option;
    System.out.print("File name: ");
    fName = kb.next();
    System.out.println("1. Add 2. Find 3. Modify a record; 4. Exit");
    System.out.print("Enter an option: ");
    option = kb.next();
    while (true) {
        if (option.charAt(0) == '1') {
            rec.readFromConsole();
            add(rec);
        }
        else if (option.charAt(0) == '2') {
            rec.readKey();
            System.out.print("The record is ");
            if (find(rec) == false)
                System.out.print("not ");
            System.out.println("in the database");
        }
        else if (option.charAt(0) == '3') {
            rec.readKey();
            modify(rec);
        }
    }
}

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        else if (option.charAt(0) != '4')
            System.out.println("Wrong option");
        else return;
        printDb(rec);
        System.out.println("1. Add 2. Find 3. Modify a record; 4. Exit");
        System.out.print("Enter an option: ");
        option = kb.next();
    }
}

static public void main(String[] a) throws IOException {
//    (new Database()).run(new Personal());
    (new Database()).run(new Student());
}
}
```