Object Relational Mapping

اَللّٰهُمَّ اُرْزُقْنِى عِلْمًا نَافِعًا وَاسِعًا عَمِيْقًا

اَللّٰهُمَّ اُرْزُقْنِى رِزْقًا وَاسِعًا حَلَالًا طَيِّبًا
مُبَارَكًا مِنْ عِنْدِكَ

Review

We have developed our UAMS using 3 Tier Model.
i.e., separate

1. Business Logic (BL)
2. Data Layer (DL)
3. User Interface (UI)

Review

We made 3 classes in the business logic.

```
class Student
{
    public string name;
    public int age;
    public double fscMarks;
    public double ecatMarks;
    public double merit;
    public List<DegreeProgram> preferences;
    public List<Subject> regSubject;
    public DegreeProgram regDegree;
}
```

```
class Subject
{
    public string code;
    public string type;
    public int creditHours;
    public int subjectFees;
}
```

```
class DegreeProgram
{
    public string degreeName;
    public float degreeDuration;
    public List<Subject> subjects;
    public int seats;
}
```

Review

Now, the question is how to Store the data related to objects in the Files.

```
class Student
{
    public string name;
    public int age;
    public double fscMarks;
    public double ecatMarks;
    public double merit;
    public List<DegreeProgram> preferences;
    public List<Subject> regSubject;
    public DegreeProgram regDegree;
}
```

```
class Subject
{
    public string code;
    public string type;
    public int creditHours;
    public int subjectFees;
}
```

```
class DegreeProgram
{
    public string degreeName;
    public float degreeDuration;
    public List<Subject> subjects;
    public int seats;
}
```

Review

DegreeProgram objects contain the list of subjects which are also objects.

```
class Student
{
    public string name;
    public int age;
    public double fscMarks;
    public double ecatMarks;
    public double merit;
    public List<DegreeProgram> preferences;
    public List<Subject> regSubject;
    public DegreeProgram regDegree;
}
```

```
class Subject
{
    public string code;
    public string type;
    public int creditHours;
    public int subjectFees;
}
```

```
class DegreeProgram
{
    public string degreeName;
    public float degreeDuration;
    public List<Subject> subjects;
    public int seats;
}
```

Review

Student objects contain the list of preferences which are also objects.

```
class Student
{
    public string name;
    public int age;
    public double fscMarks;
    public double ecatMarks;
    public double merit;
    public List<DegreeProgram> preferences;
    public List<Subject> regSubject;
    public DegreeProgram regDegree;
}
```

```
class Subject
{
    public string code;
    public string type;
    public int creditHours;
    public int subjectFees;
}
```

```
class DegreeProgram
{
    public string degreeName;
    public float degreeDuration;
    public List<Subject> subjects;
    public int seats;
}
```

Object-Relational Mapping

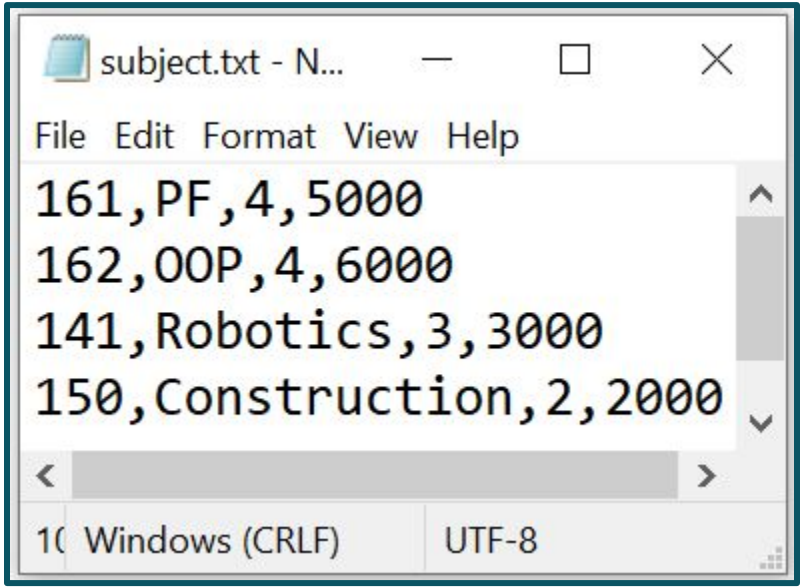
The technique for converting data of objects into permanent storage using object-oriented programming languages is Called Object-Relational Mapping (ORM)

Data in Files

Lets see how we will store the data into files.

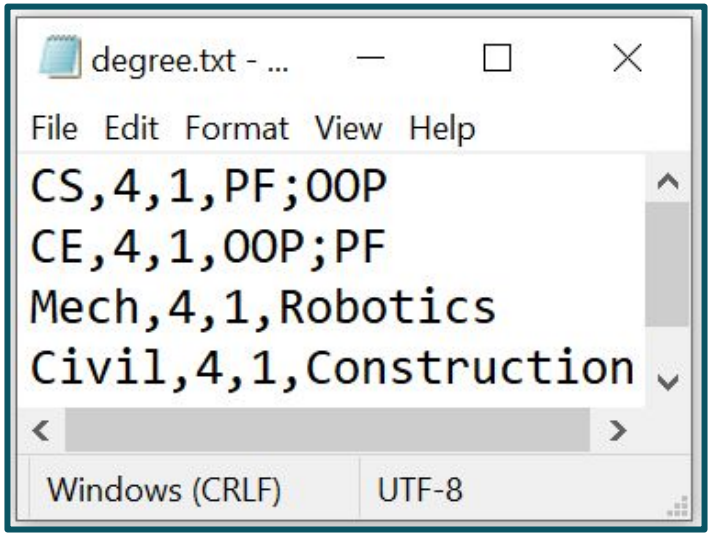
Subject Data

Fields represent the following information.
Subject Code, Subject Type, Credit Hours, Fees



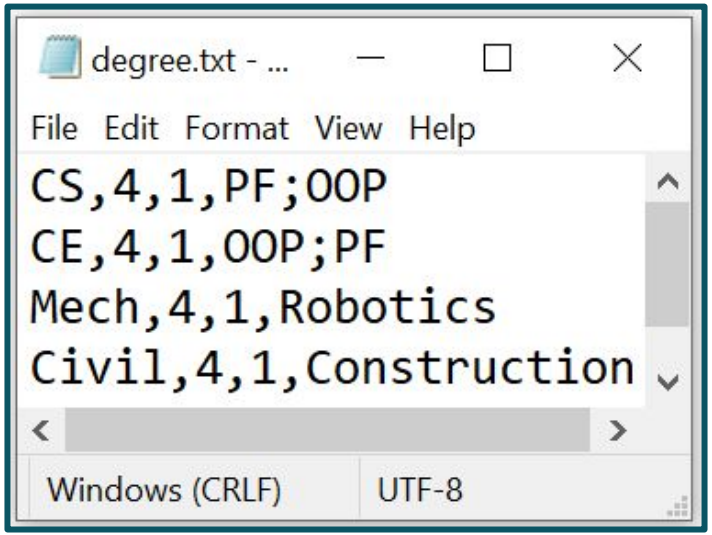
DegreeProgram Data

Fields represent the following information.
Degree Name, Duration, Seats, Subjects type



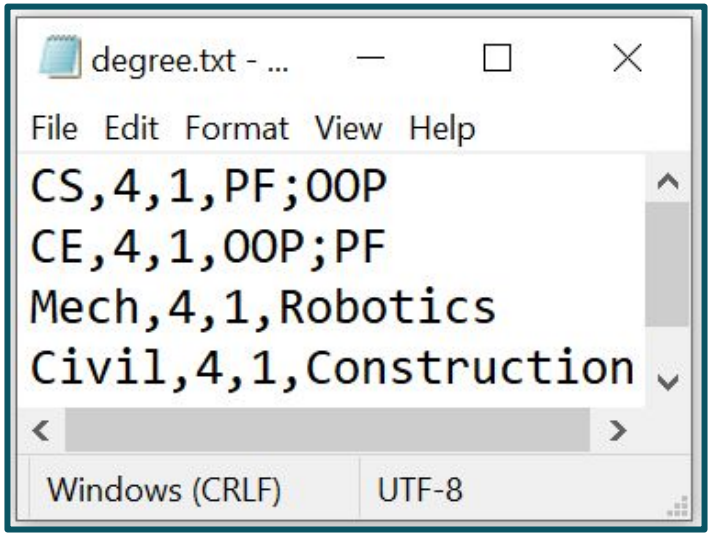
DegreeProgram Data

Important thing to note here is that we are just storing the Subject type information related to each degree.



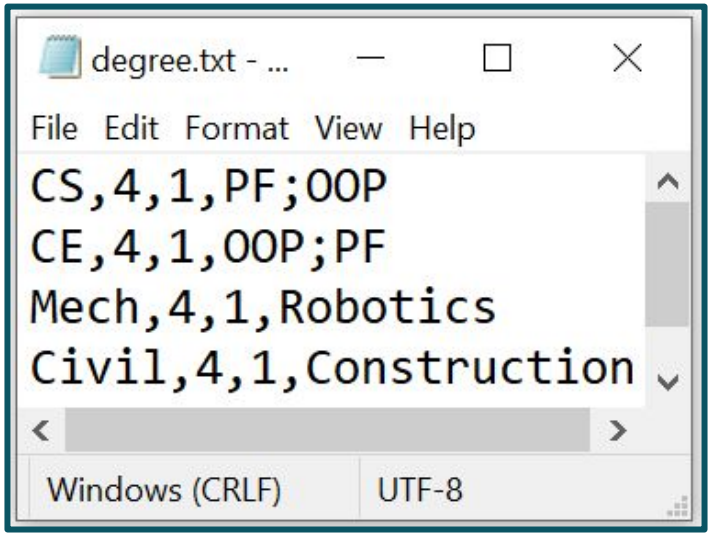
DegreeProgram Data

These Subject types information are separated by semicolons as commas are separating the fields.



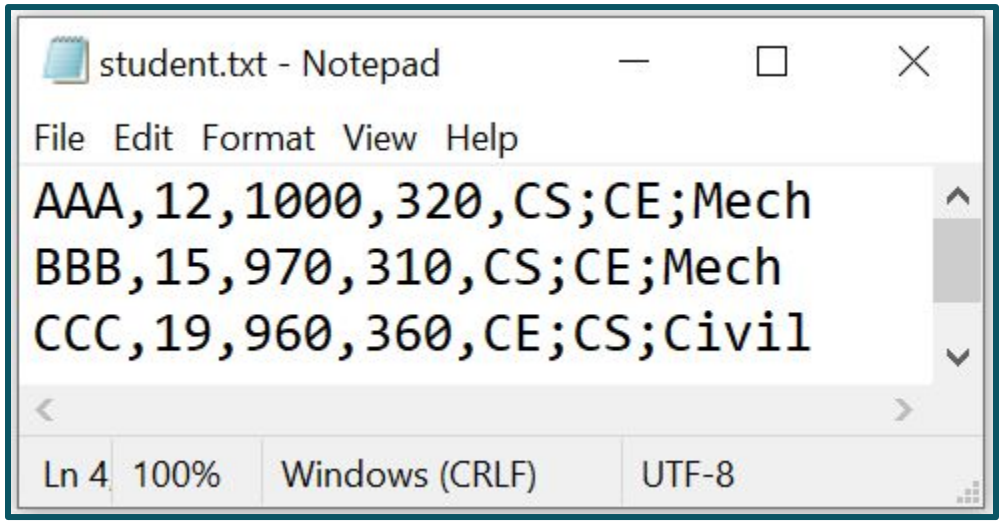
DegreeProgram Data

After reading the data into the objects in the code we will assign the related objects of subjects by comparing the Subject Type.



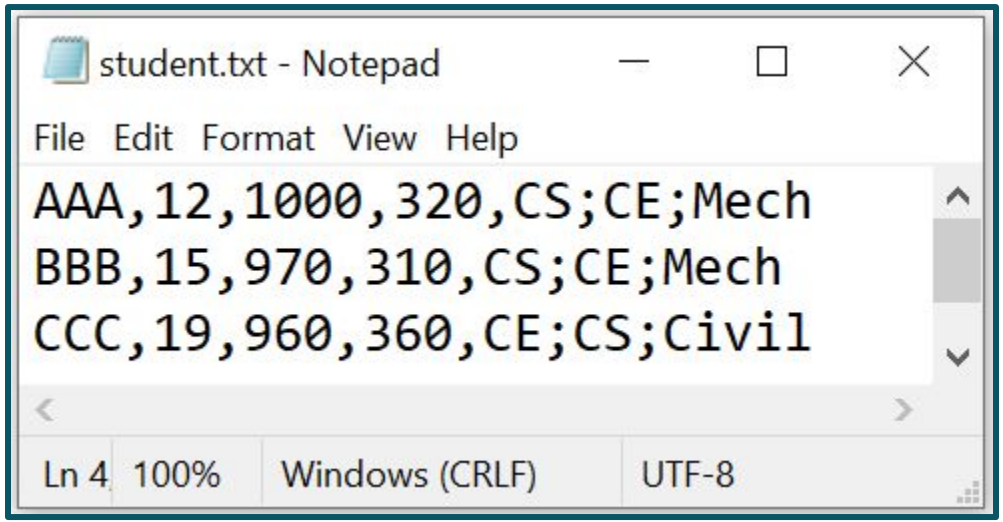
Student Data

Fields represent the following information.
Student Name, Age, Fsc Marks, Ecat Marks, Preferences



Student Data

Preferences only contain the information of the degree names.



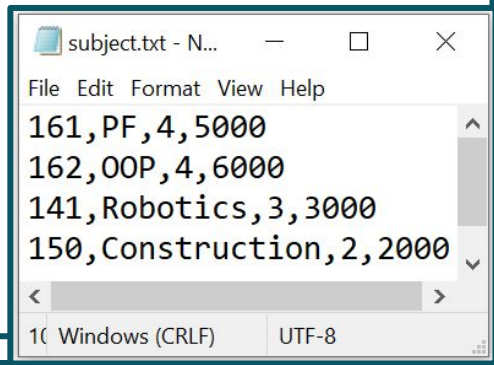
Load Data

Lets see how to load this data and created related objects.

LoadData for Subject

Previously, we had made a separate function for parseData. C# strings also provide a function Split that will split the records into string arrays after splitting on a specific character.

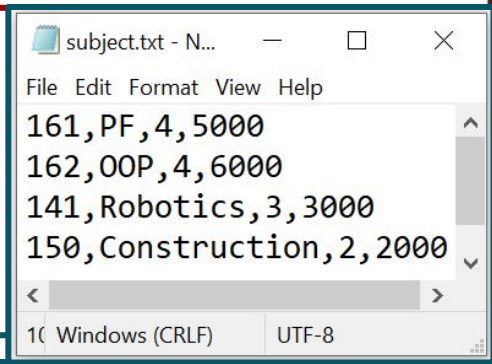
```
public static bool readFromFile(string path)
{
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path))
    {
        while ((record = f.ReadLine()) != null)
        {
            string[] splittedRecord = record.Split(',');
            string code = splittedRecord[0];
            string type = splittedRecord[1];
            int creditHours = int.Parse(splittedRecord[2]);
            int subjectFees = int.Parse(splittedRecord[3]);
            Subject s = new Subject(code, type, creditHours, subjectFees);
            addSubjectIntoList(s);
        }
        f.Close();
        return true;
    }
    else
    {
        return false;
    }
}
```



LoadData for Subject

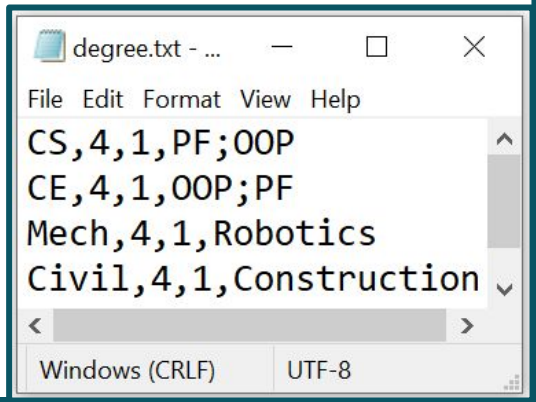
After successfully loading the data, we are creating the object and adding into the list

```
public static bool readFromFile(string path)
{
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path))
    {
        while ((record = f.ReadLine()) != null)
        {
            string[] splittedRecord = record.Split(',');
            string code = splittedRecord[0];
            string type = splittedRecord[1];
            int creditHours = int.Parse(splittedRecord[2]);
            int subjectFees = int.Parse(splittedRecord[3]);
            Subject s = new Subject(code, type, creditHours, subjectFees);
            addSubjectIntoList(s);
        }
        f.Close();
        return true;
    }
    else
    {
        return false;
    }
}
```



LoadData for DegreeProgram

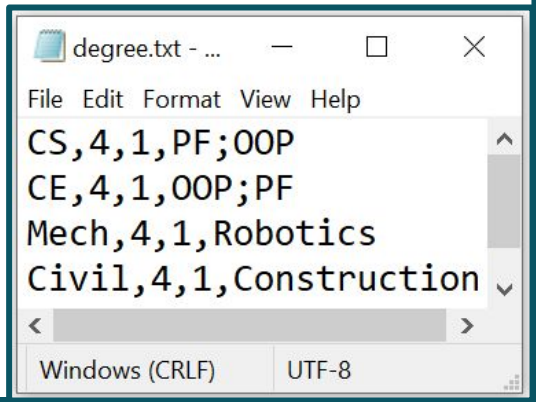
```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string degreeName = splittedRecord[0];
            float degreeDuration = float.Parse(splittedRecord[1]);
            int seats = int.Parse(splittedRecord[2]);
            string[] splittedRecordForSubject = splittedRecord[3].Split(';');
            DegreeProgram d = new DegreeProgram(degreeName, degreeDuration, seats);
            for (int x = 0; x < splittedRecordForSubject.Length; x++){
                Subject s = SubjectDL.isSubjectExists(splittedRecordForSubject[x]);
                if (s != null){
                    d.AddSubject(s);
                }
            }
            addIntoDegreeList(d);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



LoadData for DegreeProgram

We splitted the records by comma.

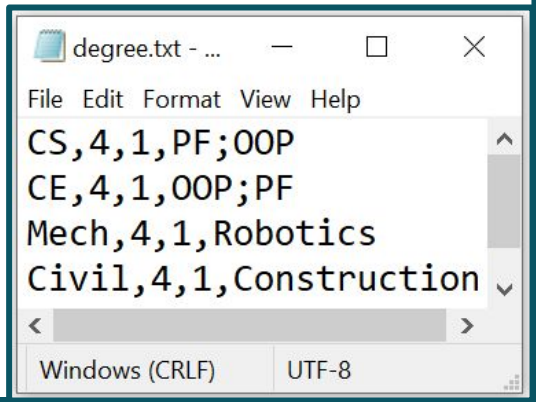
```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string degreeName = splittedRecord[0];
            float degreeDuration = float.Parse(splittedRecord[1]);
            int seats = int.Parse(splittedRecord[2]);
            string[] splittedRecordForSubject = splittedRecord[3].Split(';');
            DegreeProgram d = new DegreeProgram(degreeName, degreeDuration, seats);
            for (int x = 0; x < splittedRecordForSubject.Length; x++){
                Subject s = SubjectDL.isSubjectExists(splittedRecordForSubject[x]);
                if (s != null){
                    d.AddSubject(s);
                }
            }
            addIntoDegreeList(d);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



LoadData for DegreeProgram

Last record is again splitted by semicolon.

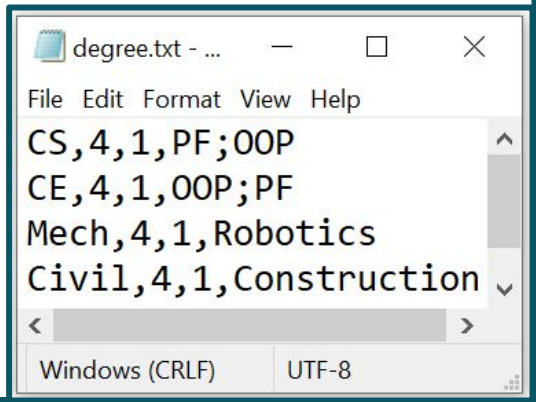
```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string degreeName = splittedRecord[0];
            float degreeDuration = float.Parse(splittedRecord[1]);
            int seats = int.Parse(splittedRecord[2]);
            string[] splittedRecordForSubject = splittedRecord[3].Split(';');
            DegreeProgram d = new DegreeProgram(degreeName, degreeDuration, seats);
            for (int x = 0; x < splittedRecordForSubject.Length; x++){
                Subject s = SubjectDL.isSubjectExists(splittedRecordForSubject[x]);
                if (s != null){
                    d.AddSubject(s);
                }
            }
            addIntoDegreeList(d);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



LoadData for DegreeProgram

Then we create the DegreeProgram objects. But we are not adding subjects right now.

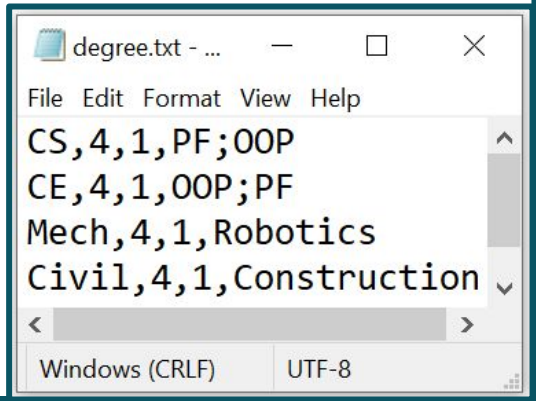
```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string degreeName = splittedRecord[0];
            float degreeDuration = float.Parse(splittedRecord[1]);
            int seats = int.Parse(splittedRecord[2]);
            string[] splittedRecordForSubject = splittedRecord[3].Split(';');
            DegreeProgram d = new DegreeProgram(degreeName, degreeDuration, seats);
            for (int x = 0; x < splittedRecordForSubject.Length; x++){
                Subject s = SubjectDL.isSubjectExists(splittedRecordForSubject[x]);
                if (s != null){
                    d.AddSubject(s);
                }
            }
            addIntoDegreeList(d);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



LoadData for DegreeProgram

Here we are returning the reference of subject if it exists in the subjectList.

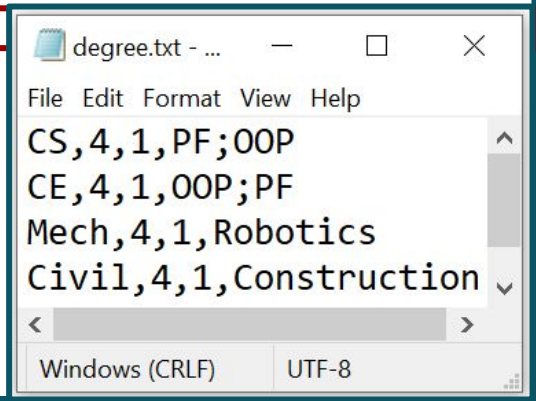
```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string degreeName = splittedRecord[0];
            float degreeDuration = float.Parse(splittedRecord[1]);
            int seats = int.Parse(splittedRecord[2]);
            string[] splittedRecordForSubject = splittedRecord[3].Split(';');
            DegreeProgram d = new DegreeProgram(degreeName, degreeDuration, seats);
            for (int x = 0; x < splittedRecordForSubject.Length; x++){
                Subject s = SubjectDL.isSubjectExists(splittedRecordForSubject[x]);
                if (s != null){
                    d.AddSubject(s);
                }
            }
            addIntoDegreeList(d);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



LoadData for DegreeProgram

Then, adding the subject into the subject list of DegreeProgram.

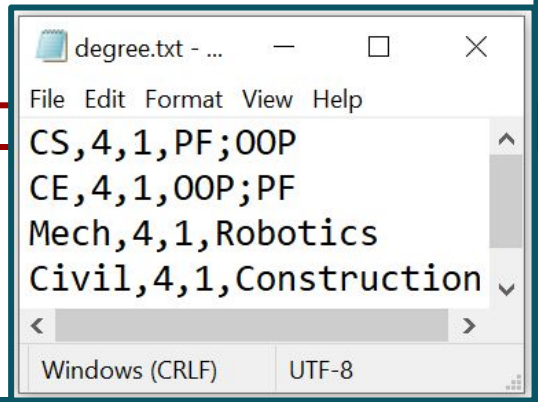
```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string degreeName = splittedRecord[0];
            float degreeDuration = float.Parse(splittedRecord[1]);
            int seats = int.Parse(splittedRecord[2]);
            string[] splittedRecordForSubject = splittedRecord[3].Split(';');
            DegreeProgram d = new DegreeProgram(degreeName, degreeDuration, seats);
            for (int x = 0; x < splittedRecordForSubject.Length; x++){
                Subject s = SubjectDL.isSubjectExists(splittedRecordForSubject[x]);
                if (s != null){
                    d.AddSubject(s);
                }
            }
            addIntoDegreeList(d);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



LoadData for DegreeProgram

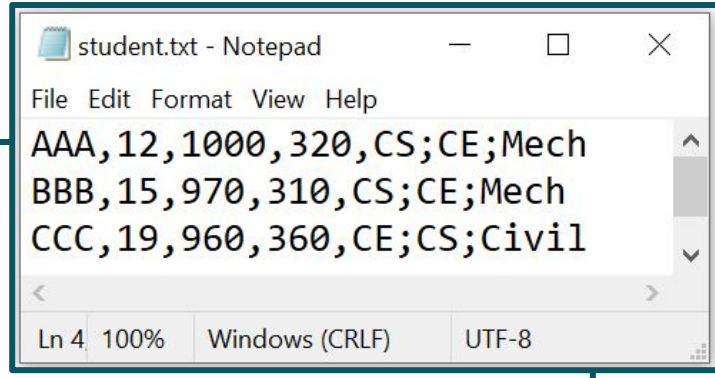
Then, adding the degree into the DegreeProgram list.

```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string degreeName = splittedRecord[0];
            float degreeDuration = float.Parse(splittedRecord[1]);
            int seats = int.Parse(splittedRecord[2]);
            string[] splittedRecordForSubject = splittedRecord[3].Split(';');
            DegreeProgram d = new DegreeProgram(degreeName, degreeDuration, seats);
            for (int x = 0; x < splittedRecordForSubject.Length; x++){
                Subject s = SubjectDL.isSubjectExists(splittedRecordForSubject[x]);
                if (s != null){
                    d.AddSubject(s);
                }
            }
            addIntoDegreeList(d);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



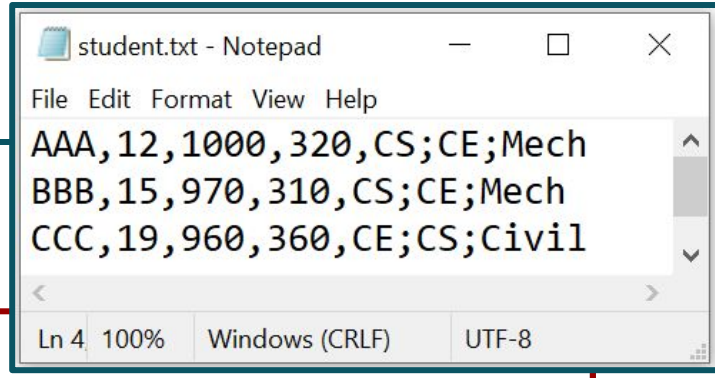
LoadData for Student

```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string name = splittedRecord[0];
            int age = int.Parse(splittedRecord[1]);
            double fscMarks = double.Parse(splittedRecord[2]);
            double ecatMarks = double.Parse(splittedRecord[3]);
            string[] splittedRecordForPreference = splittedRecord[4].Split(';');
            List<DegreeProgram> preferences = new List<DegreeProgram>();
            for (int x = 0; x < splittedRecordForPreference.Length; x++){
                DegreeProgram d = DegreeProgramDL.isDegreeExists(splittedRecordForPreference[x]);
                if (d != null){
                    if (!(preferences.Contains(d)))
                        preferences.Add(d);
                }
            }
            Student s = new Student(name, age, fscMarks, ecatMarks, preferences);
            studentList.Add(s);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



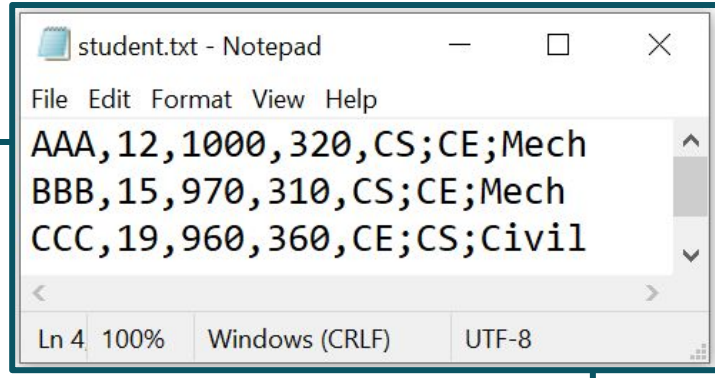
LoadData for Student

```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string name = splittedRecord[0];
            int age = int.Parse(splittedRecord[1]);
            double fscMarks = double.Parse(splittedRecord[2]);
            double ecatMarks = double.Parse(splittedRecord[3]);
            string[] splittedRecordForPreference = splittedRecord[4].Split(';');
            List<DegreeProgram> preferences = new List<DegreeProgram>();
            for (int x = 0; x < splittedRecordForPreference.Length; x++){
                DegreeProgram d = DegreeProgramDL.isDegreeExists(splittedRecordForPreference[x]);
                if (d != null){
                    if (!(preferences.Contains(d)))
                        preferences.Add(d);
                }
            }
            Student s = new Student(name, age, fscMarks, ecatMarks, preferences);
            studentList.Add(s);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



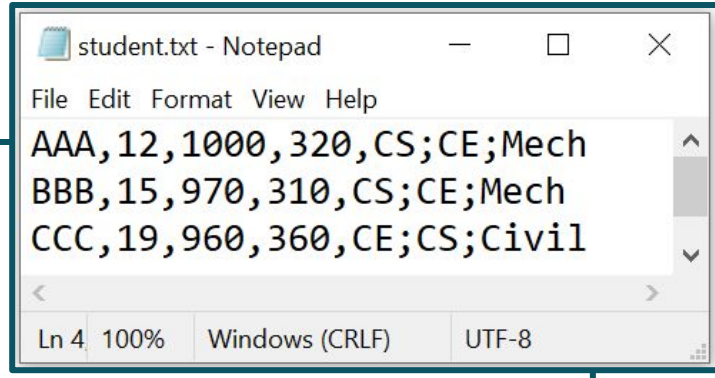
LoadData for Student

```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string name = splittedRecord[0];
            int age = int.Parse(splittedRecord[1]);
            double fscMarks = double.Parse(splittedRecord[2]);
            double ecatMarks = double.Parse(splittedRecord[3]);
            string[] splittedRecordForPreference = splittedRecord[4].Split(';');
            List<DegreeProgram> preferences = new List<DegreeProgram>();
            for (int x = 0; x < splittedRecordForPreference.Length; x++){
                DegreeProgram d = DegreeProgramDL.isDegreeExists(splittedRecordForPreference[x]);
                if (d != null){
                    if (!(preferences.Contains(d)))
                        preferences.Add(d);
                }
            }
            Student s = new Student(name, age, fscMarks, ecatMarks, preferences);
            studentList.Add(s);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



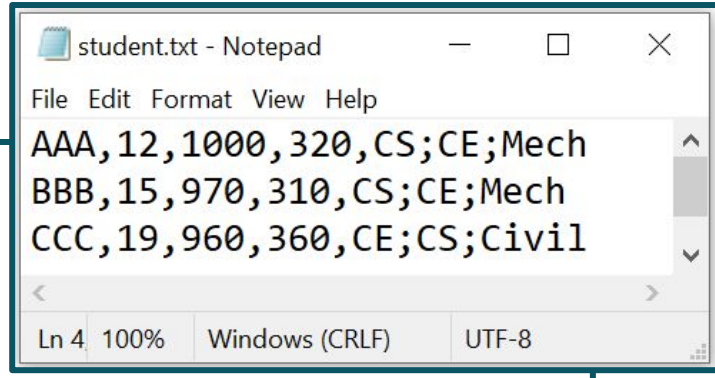
LoadData for Student

```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string name = splittedRecord[0];
            int age = int.Parse(splittedRecord[1]);
            double fscMarks = double.Parse(splittedRecord[2]);
            double ecatMarks = double.Parse(splittedRecord[3]);
            string[] splittedRecordForPreference = splittedRecord[4].Split(';');
            List<DegreeProgram> preferences = new List<DegreeProgram>();
            for (int x = 0; x < splittedRecordForPreference.Length; x++){
                DegreeProgram d = DegreeProgramDL.isDegreeExists(splittedRecordForPreference[x]);
                if (d != null){
                    if (!(preferences.Contains(d)))
                        preferences.Add(d);
                }
            }
            Student s = new Student(name, age, fscMarks, ecatMarks, preferences);
            studentList.Add(s);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



LoadData for Student

```
public static bool readFromFile(string path){
    StreamReader f = new StreamReader(path);
    string record;
    if (File.Exists(path)){
        while ((record = f.ReadLine()) != null){
            string[] splittedRecord = record.Split(',');
            string name = splittedRecord[0];
            int age = int.Parse(splittedRecord[1]);
            double fscMarks = double.Parse(splittedRecord[2]);
            double ecatMarks = double.Parse(splittedRecord[3]);
            string[] splittedRecordForPreference = splittedRecord[4].Split(';');
            List<DegreeProgram> preferences = new List<DegreeProgram>();
            for (int x = 0; x < splittedRecordForPreference.Length; x++){
                DegreeProgram d = DegreeProgramDL.isDegreeExists(splittedRecordForPreference[x]);
                if (d != null){
                    if (!(preferences.Contains(d)))
                        preferences.Add(d);
                }
            }
            Student s = new Student(name, age, fscMarks, ecatMarks, preferences);
            studentList.Add(s);
        }
        f.Close();
        return true;
    }
    else
        return false;
}
```



Driver Program: before displaying the menu

```
string subjectPath = "subject.txt";
string degreePath = "degree.txt";
string studentPath = "student.txt";
if (SubjectDL.readFromFile(subjectPath))
{
    Console.WriteLine("Subject Data Loaded Successfully");
}
if (DegreeProgramDL.readFromFile(degreePath))
{
    Console.WriteLine("DegreeProgram Data Loaded Successfully");
}
if (StudentDL.readFromFile(studentPath))
{
    Console.WriteLine("Student Data Loaded Successfully");
}
```

Store Data in Files

Lets see how we will store the data into files.

StoreData for Subject

```
public static void storeintoFile(string path, Subject s)
{
    StreamWriter f = new StreamWriter(path, true);
    f.WriteLine(s.code + "," + s.type + "," + s.creditHours + "," + s.subjectFees);
    f.Flush();
    f.Close();
}
```

StoreData for Student

```
public static void storeintoFile(string path, Student s)
{
    StreamWriter f = new StreamWriter(path, true);
    string degreeNames = "";
    for(int x = 0; x < s.preferences.Count - 1; x++)
    {
        degreeNames = degreeNames + s.preferences[x].degreeName + ";";
    }
    degreeNames = degreeNames + s.preferences[s.preferences.Count - 1].degreeName;
    f.WriteLine(s.name + "," + s.age + "," + s.fscMarks + "," + s.ecatMarks + "," + degreeNames);
    f.Flush();
    f.Close();
}
```

StoreData for Student

First, we make a string by concatenation for degree names using semicolons.

```
public static void storeintoFile(string path, Student s)
{
    StreamWriter f = new StreamWriter(path, true);
    string degreeNames = "";
    for(int x = 0; x < s.preferences.Count - 1; x++)
    {
        degreeNames = degreeNames + s.preferences[x].degreeName + ";";
    }
    degreeNames = degreeNames + s.preferences[s.preferences.Count - 1].degreeName;
    f.WriteLine(s.name + "," + s.age + "," + s.fscMarks + "," + s.ecatMarks + "," + degreeNames);
    f.Flush();
    f.Close();
}
```

StoreData for Student

Then write the data into the file.

```
public static void storeintoFile(string path, Student s)
{
    StreamWriter f = new StreamWriter(path, true);
    string degreeNames = "";
    for(int x = 0; x < s.preferences.Count - 1; x++)
    {
        degreeNames = degreeNames + s.preferences[x].degreeName + ";";
    }
    degreeNames = degreeNames + s.preferences[s.preferences.Count - 1].degreeName;
    f.WriteLine(s.name + "," + s.age + "," + s.fscMarks + "," + s.ecatMarks + "," + degreeNames);
    f.Flush();
    f.Close();
}
```

StoreData for Student

We did not want to have semicolon after the last degree name therefore we concatenated it separately.

```
public static void storeintoFile(string path, Student s)
{
    StreamWriter f = new StreamWriter(path, true);
    string degreeNames = "";
    for(int x = 0; x < s.preferences.Count - 1; x++)
    {
        degreeNames = degreeNames + s.preferences[x].degreeName + ";";
    }
    degreeNames = degreeNames + s.preferences[s.preferences.Count - 1].degreeName;
    f.WriteLine(s.name + "," + s.age + "," + s.fscMarks + "," + s.ecatMarks + "," + degreeNames);
    f.Flush();
    f.Close();
}
```

StoreData for DegreeProgram

Same goes for Degree Programs.

```
public static void storeintoFile(string path, DegreeProgram d)
{
    StreamWriter f = new StreamWriter(path, true);
    string SubjectNames = "";
    for(int x = 0; x < d.subjects.Count - 1; x++)
    {
        SubjectNames = SubjectNames + d.subjects[x].type + ";";
    }
    SubjectNames = SubjectNames + d.subjects[d.subjects.Count - 1].type;
    f.WriteLine(d.degreeName + "," + d.degreeDuration + "," + d.seats + "," + SubjectNames);
    f.Flush();
    f.Close();
}
```

Driver Program

Just add one function call to store the data into the file as the data is added into the list.

```
if (option == 1)
{
    if (DegreeProgramDL.programList.Count > 0)
    {
        Student s = StudentUI.takeInputForStudent();
        StudentDL.addIntoStudentList(s);
        StudentDL.storeintoFile(studentPath, s);
    }

}
else if (option == 2)
{
    DegreeProgram d = DegreeProgramUI.takeInputForDegree();
    DegreeProgramDL.addIntoDegreeList(d);
    DegreeProgramDL.storeintoFile(degreePath, d);
}
```

Driver Program

Just add one function call to store the data into the file as the data is added into the list.

```
if (option == 1)
{
    if (DegreeProgramDL.programList.Count > 0)
    {
        Student s = StudentUI.takeInputForStudent();
        StudentDL.addIntoStudentList(s);
        StudentDL.storeintoFile(studentPath, s);
    }

}
else if (option == 2)
{
    DegreeProgram d = DegreeProgramUI.takeInputForDegree();
    DegreeProgramDL.addIntoDegreeList(d);
    DegreeProgramDL.storeintoFile(degreePath, d);
}
```

Conclusion

- The technique for converting data of objects into permanent storage using object-oriented programming languages is Called Object-Relational Mapping (ORM)

Learning Objective

Write Code for Storing and Loading data of objects from files.