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Лабораторна робота 7

Тема. Об'єктно орієнтована декомпозиція. Рефакторинг – реорганізація програмного коду

Задачі:

1. Оптимізувати структуру класів, згрупувавши методи обробки відповідних класах згідно з призначенням.
2. Реалізувати можливість перегляду користувачем довідника студентів, продемонструвавши різні варіанти застосування LINQ:
   - відкладене виконання запитів;
   - примусове виконання запитів;
   - використання статистичних функцій;
   - використання лямбда виражень;
   - змішаний синтаксис запиту та методу

Опис класів

Container – власний клас контейнера для реалізації колекції об'єктів;

ContainerEnumerator – клас, який реалізує інтерфейс IEnumerator;

DataProcessing – клас, який виконує обробку даних студента;

DataPrintService – клас, який виконує роботу з виводу даних;

FileService – клас, який виконує роботу із файлами;

Текст програми

Container.cs

```
using System;
using System.Collections;
using System.Linq;
using menshakov01;

namespace menshakov07
{
    /// <summary>
    /// Class Container
    /// class that implements class container
    /// for collection of students
    /// </summary>
    public class Container
    {
        /// <summary>
        /// Private field students
        /// </summary>
        private Student[] _students;

        /// <summary>
        /// Constructor with one parameter
        /// </summary>
        /// <param name="students"></param>
        public Container(Student[] students)
        {
            _students = new Student[students.Length];

            for (var i = 0; i < students.Length; i++)
            {
                _students[i] = students[i];
            }
        }

        /// <summary>
        ///
        /// </summary>
        public Student[] Students => _students;

        /// <summary>
        /// Method that adds student to collection
        /// </summary>
        /// <param name="student"></param>
        public void Add(Student student)
        {
            if (student == null)
            {
                throw new ArgumentNullException(nameof(student), "Student is null");
            }

            var newArr = new Student[_students.Length + 1];
            for (var i = 0; i < _students.Length; i++)
            {
                newArr[i] = _students[i];
            }

            newArr[newArr.Length - 1] = student;
            _students = newArr;
        }
        /// <summary>
        /// Method that removes student from collection
        /// </summary>
        /// <param name="student"></param>
        /// <returns>True if student was removed otherwise false</returns>
        public bool Remove(Student student)
        {
            if (student == null)
            {
                return false;
            }

            var pos = -1;
            for (var i = 0; i < _students.Length; i++)
            {
                if (_students[i].Equals(student))
                {
                    pos = i;
                    break;
                }
            }

            if (pos == -1)
            {
                return false;
            }

            var newArr = new Student[_students.Length - 1];
            for (var i = 0; i < pos; i++)
            {
                newArr[i] = _students[i];
            }

            for (var i = pos + 1; i < _students.Length; i++)
            {
                newArr[i - 1] = _students[i];
            }

            _students = newArr;
            return true;
        }

        /// <summary>
        /// Method that clears the collection
        /// </summary>
        public void Clear()
        {
            _students = null;
        }

        /// <summary>
        /// Method that removes student by chosen criteria
        /// </summary>
        /// <returns>True if student was removed otherwise false</returns>
        public bool RemoveByCriteria()
        {
            Console.WriteLine("Enter criteria of the deletion:");
            Console.WriteLine("1) group index");
            Console.WriteLine("2) specialty");
            Console.WriteLine("3) faculty\n");
            Student[] students = null;
            var input = Console.ReadLine();
            switch (input)
            {
                case "group index":
                    Console.WriteLine("Write group index:");
                    input = Console.ReadLine();
                    students = _students.Where(s => s.GroupIndex.Equals(Convert.ToCha
r(input))).ToArray();
                    break;
                case "specialty":
                    Console.WriteLine("Write specialty:");
                    input = Console.ReadLine();
                    students = _students.Where(s => s.Specialty.Equals(input)).ToArra
y();
                    break;
                case "faculty":
                    Console.WriteLine("Write faculty:");
                    input = Console.ReadLine();
                    students = _students.Where(s => s.Faculty.Equals(input)).ToArray(
);
                    break;
                default:
                    input = string.Empty;
                    Console.WriteLine("Invalid option\n");
                    break;
            }

            if (!string.IsNullOrEmpty(input))
            {
                var previousSize = _students.Length;
                foreach (var item in _students.Intersect(students))
                {
                    Remove(item);
                }

                if (previousSize != _students.Length)
                {
                    return true;
                }
            }

            return false;
        }

        /// <summary>
        /// Implemented GetEnumerator method
        /// </summary>
        /// <returns>ContainerEnum</returns>
        public IEnumerator GetEnumerator()
        {
            return new ContainerEnumerator(_students);
        }
    }
}
```

ContainerEnumerator.cs

```
using menshakov01;
using System;
using System.Collections;

namespace menshakov02
{
    /// <summary>
    /// Class ContainerEnum
    /// class that implements IEnumerator for student class
    /// </summary>
    public sealed class ContainerEnumerator : IEnumerator
    {
        /// <summary>
        /// Private fields of a class
        /// </summary>
        private Student[] _students;
        private int _position = -1;

        /// <summary>
        /// Constructor with one parameter
        /// </summary>
        /// <param name="students"></param>
        public ContainerEnumerator(Student[] students)
        {
            _students = students;
        }

        /// <summary>
        /// Implemented Current property
        /// </summary>
        public object Current
        {
            get
            {
                try
                {
                    return _students[_position];
                }
                catch (IndexOutOfRangeException)
                {
                    throw new InvalidOperationException();
                }
            }
        }

        /// <summary>
        /// Implemented MoveNext method
        /// </summary>
        /// <returns></returns>
        public bool MoveNext()
        {
            _position++;
            return _position < _students.Length;
        }

        /// <summary>
        /// Implemented Reset method
        /// </summary>
        public void Reset()
        {
            _position = -1;
        }
    }
}
```

DataProcessing.cs

```
using System;
using System.Collections;
using System.Linq;
using menshakov01;

namespace menshakov07
{
    public static class DataProcessing
    {
        delegate int IsEqual(Student[] student);

        /// <summary>
        /// Method that finds student in collection
        /// </summary>
        /// <param name="student"></param>
        /// <returns>If such student exists returns it otherwise null</returns>
        public static Student Find(this Student[] students, Student student)
        {
            for (var i = 0; i < students.Length; i++)
            {
                if (students[i].Equals(student))
                {
                    return students[i];
                }
            }

            return null;
        }

        public static void Sort(this Student[] students, IComparer comparer)
        {
            Array.Sort(students, comparer);
        }

        /// <summary>
        /// Method that allows to edit data of chosen student
        /// </summary>
        /// <param name="student"></param>
        public static void EditData(this Student[] students, Student student)
        {
            var pos = -1;

            for (var i = 0; i < students.Length; i++)
            {
                if (students[i].Equals(student))
                {
                    pos = i;
                    break;
                }
            }
            if (pos != -1)
            {
                Console.WriteLine("Enter what field you want to edit:\n1) Name\n2) Su
rname\n3) Patronymic\n4) Date of birth\n5) Date of admission\n" +
                    "6) Group index\n7) Faculty\n8) Specialty\n9) Academic performanc
e\n");
                var option = Console.ReadLine();
                try
                {
                    switch (option)
                    {
                        case "Name":
                            students[pos].Name = Console.ReadLine();
                            break;
                        case "Surname":
                            students[pos].Surname = Console.ReadLine();
                            break;
                        case "Patronymic":
                            students[pos].Patronymic = Console.ReadLine();
                            break;
                        case "Date of birth":
                            students[pos].DateOfBirth = DateTime.Parse(Console.ReadLi
ne());
                            break;
                        case "Date of admission":
                            students[pos].DateOfAdmission = DateTime.Parse(Console.Re
adLine());
                            break;
                        case "Group index":
                            students[pos].GroupIndex = char.Parse(Console.ReadLine())
;
                            break;
                        case "Faculty":
                            students[pos].Faculty = Console.ReadLine();
                            break;
                        case "Specialty":
                            students[pos].Specialty = Console.ReadLine();
                            break;
                        case "Academic performance":
                            students[pos].AcademicPerformance = int.Parse(Console.Rea
dLine());
                            break;
                        default:
                            Console.WriteLine("Invalid option\n");
                            break;
                    }
                }
                catch (FormatException ex)
                {
                    Console.WriteLine(ex.Message);
                }
            }
            else
            {
                Console.WriteLine("There is no such student in collection\n");
            }
        }

        /// <summary>
        /// Method that counts chosen average value of a given collection
        /// </summary>
        /// <returns>Returns average value of a chosen field</returns>
        public static int CountAverage(this Student[] _students)
        {
            IsEqual func = null;
            Console.WriteLine("Count avg age or academic performance:");
            Console.WriteLine("1) Age");
            Console.WriteLine("2) Performance");
            var input = Console.ReadLine();
            if (input == "Age")
            {
                func = CountAvgAge;
            }
            else if (input == "Performance")
            {
                func = CountAvgPerformance;
            }
            else
            {
                Console.WriteLine("Invalid option");
                return -1;
            }

            Console.WriteLine("Enter criteria of the counting:");
            Console.WriteLine("1) group index");
            Console.WriteLine("2) specialty");
            Console.WriteLine("3) faculty\n");
            Student[] students = null;
            input = Console.ReadLine();
            switch (input)
            {
                case "group index":
                    Console.WriteLine("Write group index:");
                    input = Console.ReadLine();
                    students = _students.Where(x => x.GroupIndex.Equals(Convert.ToCha
r(input))).ToArray();
                    break;
                case "specialty":
                    Console.WriteLine("Write specialty:");
                    input = Console.ReadLine();
                    students = _students.Where(x => x.Specialty.Equals(input)).ToArra
y();

                    break;
                case "faculty":
                    Console.WriteLine("Write faculty:");
                    input = Console.ReadLine();
                    students = _students.Where(x => x.Faculty.Equals(input)).ToArray(
);

                    break;
                default:
                    input = string.Empty;
                    Console.WriteLine("Invalid option\n");
                    break;
            }

            return func(students);
        }

        /// <summary>
        /// Method that counts average students` age of a given collection
        /// </summary>
        /// <param name="students"></param>
        /// <returns>Returns average value of an age field</returns>
        private static int CountAvgAge(Student[] students)
        {
            var count = 0;

            foreach (var student in students)
            {
                count += DateTime.Now.Year - student.DateOfBirth.Year;
            }

            return count / students.Length;
        }

        /// <summary>
        /// Method that counts average students` performance of a given collection
        /// </summary>
        /// <param name="students"></param>
        /// <returns>Returns average value of an performance field</returns>
        private static int CountAvgPerformance(Student[] students)
        {

            var averagePerformance = (from student in students
                         select student.AcademicPerformance)
                        .Average();

            return (int)averagePerformance;
        }
    }
}
```

DataPrintService.cs

```
using menshakov01;
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace menshakov07
{
    class DataPrintService
    {
        /// <summary>
        /// Method that prints chosen data about student
        /// </summary>
        /// <param name="student"></param>
        public void ShowData(Student student)
        {
            var dataForPrint = new StringBuilder();
            Console.WriteLine("Enter what data you want to get:\n1) group index\n2) c
ourse\n3) age\n");
            var option = Console.ReadLine();
            switch (option)
            {
                case "group index":
                    dataForPrint.AppendFormat("\nFaculty: {0}\nSpecialty: {1}\nDate o
f admission: {2}\nGroup index: {3}", student.Faculty,
                        student.Specialty, student.DateOfAdmission.Year, student.Grou
pIndex);
```

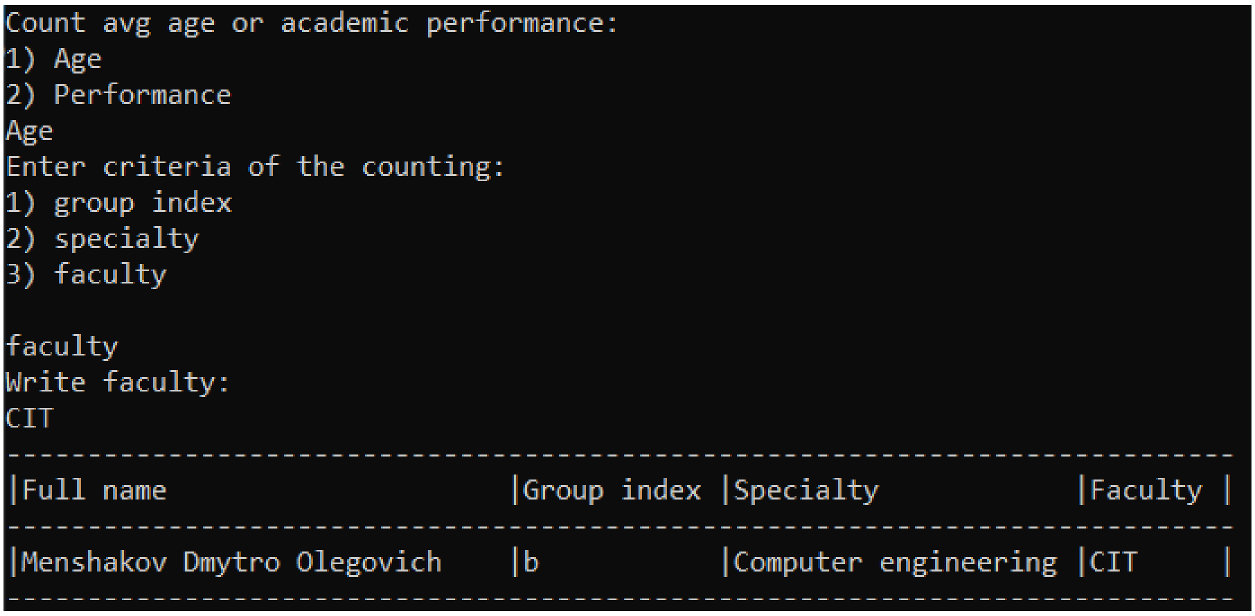
```
                    Console.WriteLine(dataForPrint.ToString());
                    dataForPrint.Clear();
                    break;
                case "course":
                    dataForPrint.AppendFormat("\nCourse: {0}\nSemester: {1}\n", (Date
Time.Now.Year - student.DateOfAdmission.Year) + 1,
                        Math.Ceiling((double)((12 * (DateTime.Now.Year -
 student.DateOfAdmission.Year) + DateTime.Now.Month - student.DateOfAdmission.Month)
                       - 2 * (DateTime.Now.Year -
 student.DateOfAdmission.Year))) / 5);
                    Console.WriteLine(dataForPrint.ToString());
                    dataForPrint.Clear();
                    break;
                case "age":
                    dataForPrint.AppendFormat("\nYears: {0}\nMonth: {1}\nDays: {2}\n"
, DateTime.Now.Year - student.DateOfBirth.Year,
                        (Math.Abs(DateTime.Now.Month - student.DateOfBirth.Month)) -
 1, DateTime.Now.Day);
                    Console.WriteLine(dataForPrint.ToString());
                    dataForPrint.Clear();
                    break;
                default:
                    Console.WriteLine("Invalid option\n");
                    break;
            }
        }

        /// <summary>
        /// Method that prints chosen data about student in table format
        /// </summary>
        public void ShowFormattedData(Student[] students)
        {
            var separator = new string('-', 76);
            var dataForPrint = new StringBuilder();
            dataForPrint.AppendFormat("|{0,-30}|{1,-12}|{2,-21}|{3,-
8}|", "Full name", "Group index", "Specialty", "Faculty");
            Console.WriteLine(separator);
            Console.WriteLine(dataForPrint);
            Console.WriteLine(separator);
            foreach (var student in students)
            {
                dataForPrint.Clear();
                var fullName = new StringBuilder(student.Surname + " " + student.Name
 + " " + student.Patronymic);
                dataForPrint.AppendFormat("|{0,-30}|{1,-12}|{2,-21}|{3, -
8}|", fullName, student.GroupIndex, student.Specialty, student.Faculty);
                Console.WriteLine(dataForPrint);
                Console.WriteLine(separator);
            }
        }
    }
}
```

FileService.cs

```
using menshakov01;
using System;
using System.IO;
using System.Runtime.Serialization.Json;

namespace menshakov07
{
    public class FileService
    {
        /// <summary>
        /// Method that writes students' data to JSON file
        /// </summary>
        public void WriteToFile(Student[] students)
        {
            var jsonFormatter = new DataContractJsonSerializer(typeof(Student[]));

            try
            {
                using (var file = new FileStream("students.json", FileMode.Create))
                {
                    try
                    {
                        jsonFormatter.WriteObject(file, students);
                    }
                    catch (System.Runtime.Serialization.SerializationException ex)
                    {
                        Console.WriteLine(ex.Message);
                    }
                }
            }
            catch (UnauthorizedAccessException ex)
            {
                Console.WriteLine(ex.Message);
            }
        }

        /// <summary>
        /// Method that reads students' data from JSON file
        /// </summary>
        public void ReadFromFile(Student[] students)
        {
            if (students != null)
            {
                var jsonFormatter = new DataContractJsonSerializer(typeof(Student[]))
;

                try
                {
                    using (var file = new FileStream("students.json", FileMode.Open))
                    {
                        try
                        {
                            students = jsonFormatter.ReadObject(file) as Student[];
                        }
                        catch (System.Runtime.Serialization.SerializationException ex
)
                        {
                            Console.WriteLine(ex.Message);
                        }
                    }
                }
                catch (FileNotFoundException ex)
                {
                    Console.WriteLine(ex.Message);
                }
            }
            else
            {
                Console.WriteLine("There are no students in container\n");
            }
        }
    }
}
```

Program.cs

```
using menshakov01;
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace menshakov07
{
    class Program
    {
        static void Main(string[] args)
        {
            var customStudent = new Student("Momot", "Roman", "Evegenievich", DateTim
e.Parse("10-8-2001"), DateTime.Parse("16-05-
2019"), 'b', "CIT", "Computer engineering", 80);
            var students = new Student[] { new Student("Bily", "Vadim", "Ivanovich",
DateTime.Parse("12-6-2001"), DateTime.Parse("16-05-
2019"), 'a', "CIT", "Computer engineering", 100),
                new Student("Menshakov", "Dmytro", "Olegovich", DateTime.Parse("16-
11-2000"), DateTime.Parse("23-8-2019"), 'b', "CIT", "Computer engineering", 90)};
            var list = new Container(students);
            list.Add(customStudent);
            list.Students.CountAverage();
            var query = from student in students
                        where student.GroupIndex == 'b'
                        select student;
            var dataPrintService = new DataPrintService();
            dataPrintService.ShowFormattedData(query.ToArray());
        }
    }
}
```



```
Count avg age or academic performance:
1) Age
2) Performance
Age
Enter criteria of the counting:
1) group index
2) specialty
3) faculty

faculty
Write faculty:
CIT
----------------------------------------------------------------------------
|Full name                      |Group index |Specialty            |Faculty |
----------------------------------------------------------------------------
|Menshakov Dmytro Olegovich     |b           |Computer engineering |CIT     |
----------------------------------------------------------------------------
```

Результати роботи програми

Висновок: у результаті виконання лабораторної роботи було оптимізовано структуру класів, згрупувавши методи обробки відповідних класах згідно з призначенням, реалізовано можливість перегляду користувачем довідника студентів, за використанням різних варіантів застосування LINQ: відкладене виконання, примусове, використання статистичних функцій та лямбда виражень, змішаний синтаксис запиту та методу.