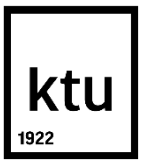


Kauno technologijos universitetas
Informatikos fakultetas

Objektinis programavimas 2 (P175B123)

Laboratorinių darbų ataskaita

Normantas Stankevičius IFF-1/4

Studentas

Prof. Vacius Jusas

Dėstytojas

Kaunas 2022

TURINYS

1. Rekursija (L1)

1.1. Darbo užduotis

LD_16.Pažintis.
Įvairių miesto mokyklų geriausi moksleiviai važiuoja į ekskursiją. Nors moksleiviai yra iš skirtingų mokyklų, tačiau yra tokių, kurie pažįsta vieni kitus. Moksleiviai nori užmegzti naujas pažintis, tačiau su nepažįstamu moksleiviu galima susipažinti tik tuomet, jeigu yra pažįstamų moksleivių grandinėlė (pirmas pažįsta antrą, antras pažįsta trečią, trečias pažįsta ketvirtą, tuomet pirmas gali susipažinti su ketvirtu), kuri veda iki nepažįstamo moksleivio. Pirmame tekstiniame faile 'U31DUOM.TXT' apie moksleivius pateikta tokia informacija: moksleivio vardas, jo pažįstamų moksleivių kiekis, pažįstamų moksleivių vardai. Kiekvienam moksleiviui tekstiniame faile yra skirta po vieną eilutę. Antrame tekstiniame faile 'U32DUOM.TXT' vienoje

eilutėje nurodyti dviejų moksleivių vardai. Tokių eilučių gali būti keletas. Abiejuose failuose moksleivių duomenys skiriami bent vienu tarpu.
Nustatykite kiekvienai moksleivių porai iš antrojo failo ar jie jau yra pažįstami, ar jie gali susipažinti (jeigu gali, reikia nurodyti visus bendrus pažįstamus moksleivius), ar jie negali susipažinti (bendro pažįstamo moksleivio neturi). Spausdinkite poros vardus, šalia nurodant atsakymą, kaip žemiau pateiktame pavyzdyje.

Pirmasis duomenų failas 'U31DUOM.TXT':

```
Rūta     1 Arnoldas
Agnė     3 Nerijus Neda Antanas
Nerijus  1 Agnė
Antanas  2 Agnė Marius
Marius   2 Antanas  Neda
Neda     3 Marius Rūta Agnė
Arnoldas 1 Rūta
```

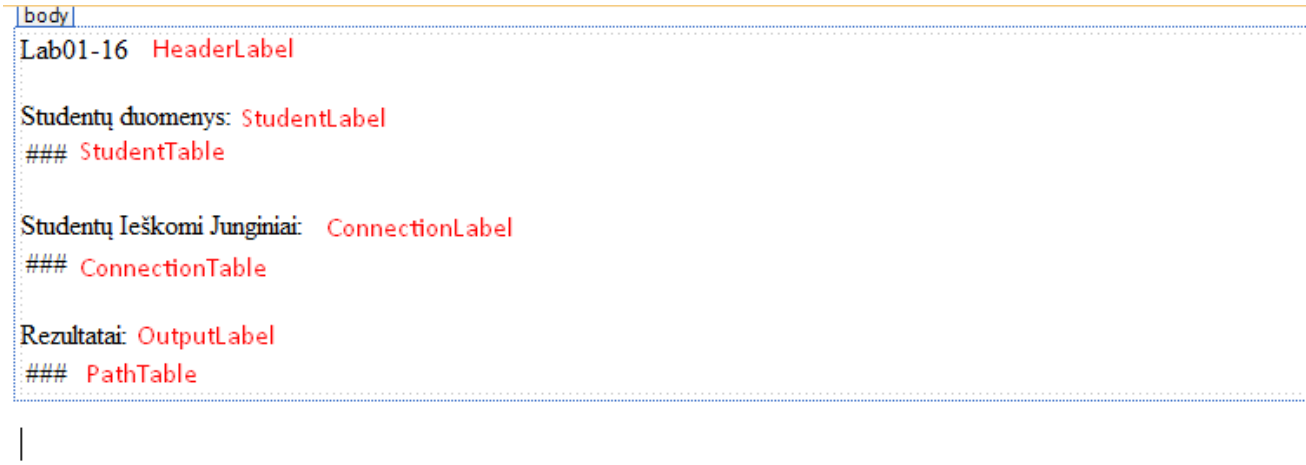
Antrasis duomenų failas 'U32DUOM.TXT':

```
Rūta       Nerijus
Agnė       Antanas
Neda       Nerijus
```

Rezultatų failas 'U3REZ.TXT':

```
Rūta       Nerijus    negali susipažinti
Agnė       Antanas    jau pažįstami
Neda       Nerijus    bendri pažįstami: Agnė
```

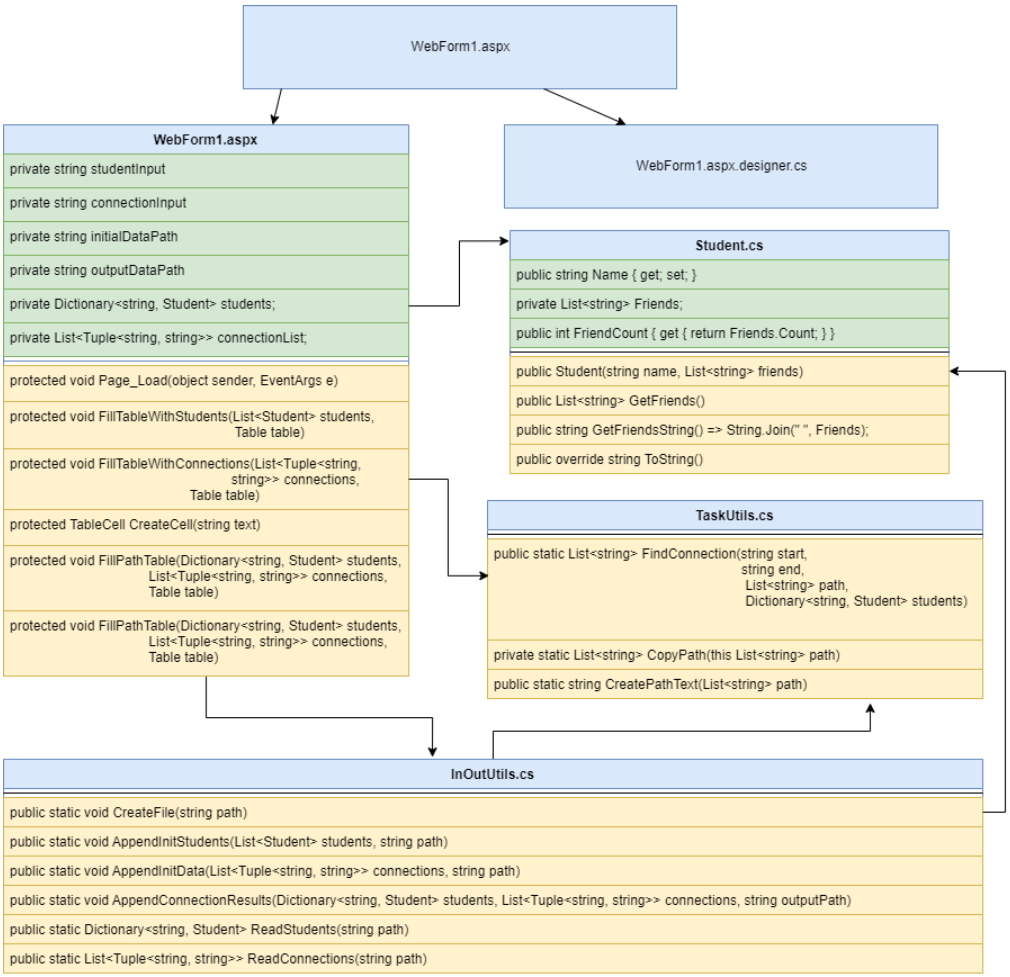
1.2. Grafinės vartotojo sąsajos schema



1.3. Sąsajoje panaudotų komponentų keičiamos savybės

Komponentas	Savybė	Reikšmė
HeaderLabel	Text	"Lab01-16"
StudentLabel	Text	"Studentų duomenys:"
ConnectionLabel	Text	"Studentų Ieškomi Junginiai:"
OutputLabel	Text	"Rezultatai:"

1.4. Klasių diagrama



1.5. Programos vartotojo vadovas

Atsidarius programą, programa nuskaito App_Data/students.txt ir App_Data/connections.txt. Naudojant tą informaciją, parašo visą informaciją į StudentTable, ConnectionTable, PathTable su duota ir apskaičiuota informacija.

1.6. Programos tekstas

`InOutUtils.cs:`

```
using System;
using System.Collections.Generic;
using System.IO;
using System.Linq;
using System.Web;

namespace Lab01
{
    /// <summary>
    /// InOutUtils class for reading and writing data from/to a file
    /// </summary>
    public static class InOutUtils
    {
        /// <summary>
        /// Creates a new empty file, ready for appending data
```

```
        /// </summary>
        /// <param name="path">path to the file</param>
        public static void CreateFile(string path)
        {
            using (FileStream fs = new FileStream(path, FileMode.Create))
                new StreamWriter(fs, encoding: System.Text.Encoding.UTF8).Close();
        }


        /// <summary>
        /// appends initial student data to TXT file
        /// </summary>
        /// <param name="students">List of all students (Student object)</param>
        /// <param name="path">path to the file where information will be
appended</param>
        public static void AppendInitStudents(List<Student> students, string path)
        {
            using (StreamWriter sr = new StreamWriter(path, append: true))
            {
                sr.WriteLine("Studentai ir jų draugai");
                sr.WriteLine($"{"Studentas",-20}|{"Draugų kiekis",-20}|{"Draugai:"}");
                foreach (Student student in students)
                    sr.WriteLine(student);
                sr.WriteLine();
            }
        }

        /// <summary>
        /// Appends initial connection data to output file
        /// </summary>
        /// <param name="connections">List of Tuples(string, string) that work as nodes
from student a to student b while using DFS</param>
        /// <param name="path">path to the file where to append initial data</param>
        public static void AppendInitData(List<Tuple<string, string>> connections, string
path)
        {
            using (StreamWriter sr = new StreamWriter(path, append: true))
            {
                sr.WriteLine("Studentai ir jų ieškomi draugai:");
                sr.WriteLine($"{"Studentas",-20} {"Ieškomas draugas",-20}");
                foreach (Tuple<string, string> connection in connections)
                    sr.WriteLine($"{connection.Item1,-20} {connection.Item2,-20}");
                sr.WriteLine();
            }
        }

        /// <summary>
        /// Appends output connection data to output file
        /// </summary>
        /// <param name="students">Dictionary, key -> string, name of the student, value
-> Student class object of the student</param>
        /// <param name="connections">List of tuples(string, string) that is compromised
of student names that work as nodes that are used for DFS</param>
        /// <param name="outputPath">output path to the txt file where data will be
APPENDED</param>
        public static void AppendConnectionResults(Dictionary<string, Student> students,
List<Tuple<string, string>> connections, string outputPath)
        {

            using (StreamWriter sr = new StreamWriter(outputPath))
            {
                sr.WriteLine("Draugai ir jų junginiai, bei keliai:");
                sr.WriteLine($"{"Draugas",-20}|{"Ieškomas draugas:",-20}|{"Kelias:"}");
                foreach (Tuple<string, string> connection in connections)
                {
                    List<string> studentPath = new List<string>();
                    studentPath.Add(connection.Item1);
```

```
                    studentPath = TaskUtils.FindConnection(connection.Item1,
connection.Item2, studentPath, students);
                    string pathText = TaskUtils.CreatePathText(studentPath);
                    sr.WriteLine($"{connection.Item1,-20}|{connection.Item2,-
20}|{pathText}");
                }
            }
        }

        /// <summary>
        /// Creates a name to Student class object relation dictionary
        /// </summary>
        /// <param name="path">Path to the the text file containing the data</param>
        /// <returns>Dictionary(key -> string, value -> Student class object) </returns>
        public static Dictionary<string, Student> ReadStudents(string path)
        {
            Dictionary<string, Student> students = new Dictionary<string, Student>();
            using (StreamReader sr = new StreamReader(path))
            {
                string line;
                while ((line = sr.ReadLine()) != null)
                {
                    string[] elements = line.Split(' ');
                    string name = elements[0];
                    List<string> friends = new List<string>();
                    for (int i = 2; i < elements.Length; i++)
                        friends.Add(elements[i]);

                    students.Add(name, new Student(name, friends));
                }
            }
            return students;
        }

        /// <summary>
        /// Gets the connections of students
        /// </summary>
        /// <param name="path">.txt file to the input</param>
        /// <returns>List of Tupples(string, string)</returns>
        public static List<Tuple<string, string>> ReadConnections(string path)
        {
            List<Tuple<string, string>> conncetions = new List<Tuple<string, string>>();
            using (StreamReader sr = new StreamReader(path))
            {
                string line;
                while ((line = sr.ReadLine()) != null)
                {
                    string[] elements = line.Split(' ');
                    conncetions.Add(new Tuple<string, string>(elements[0], elements[1]));
                }
            }

            return conncetions;
        }
    }
}
```

TaskUtils.cs:

```
using System;
using System.Collections.Generic;
using System.IO;
using System.Linq;
using System.Web;
```

```
namespace Lab01
{
    /// <summary>
    /// TaskUtils class for extra (backend) computation functions
    /// </summary>
    public static class TaskUtils
    {

        /// <summary>
        /// Recursive implementation of DFS
        /// </summary>
        /// <param name="start">Start of the person</param>
        /// <param name="end">End of the person</param>
        /// <param name="path">path to current position from initial start</param>
        /// <param name="students">Dictionary, key: string (name of the student), value
Student class object</param>
        /// <returns>List of strings, that create a path from student a to b</returns>
        public static List<string> FindConnection(string start, string end, List<string>
path, Dictionary<string, Student> students)
        {
            Student curr = students[start];
            List<string> outputPath = null;
            foreach(string next in curr.GetFriends())
            {
                if (next == end)
                    return path;

                else if (path.Contains(next)) // Checks if the current node has been
visited, so it does not loop
                    continue;

                Student nextStudent = students[next];
                List<string> pathCopy = path.CopyPath();
                pathCopy.Add(next);

                List<String> pathToEnd = FindConnection(next, end, pathCopy, students);
// Recursion Call

                if(outputPath == null || (pathToEnd != null && pathToEnd.Count <
outputPath.Count))
                    outputPath = pathToEnd;

            }

            return outputPath; // Did not found the path
        }

        /// <summary>
        /// Deep copies a string list
        /// </summary>
        /// <param name="path">string list</param>
        /// <returns>string list</returns>
        private static List<string> CopyPath(this List<string> path)
        {
            List<string> copy = new List<string>();
            foreach (string s in path)
                copy.Add(s);

            return copy;
        }

        /// <summary>
        /// Creates connection depending on the path
        /// </summary>
        /// <param name="path"> List of strings that the path is compromised of </param>
        /// <returns>a string form of the path from student a to student b</returns>
        public static string CreatePathText(List<string> path)
```

```
        {
            if (path == null)
                return "negali susipažinti";
            else if (path.Count == 1)
                return "jau pažįstami";
            else
            {
                path.RemoveAt(0);
                return $"bendri pažįstami: {String.Join(" ", path)}";
            }
        }


    }
}
```

Student.cs:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;

namespace Lab01
{
    /// <summary>
    /// Student Class Data Object that stores the name and connection
    /// </summary>
    public class Student
    {
        public string Name { get; set; }
        private List<string> Friends;
        public int FriendCount { get { return Friends.Count; } }

        /// <summary>
        /// Constructor
        /// </summary>
        public Student(string name, List<string> friends)
        {
            Name = name;
            Friends = new List<string>();
            foreach (string friend in friends)
                Friends.Add(friend);
        }

        /// <summary>
        /// Copies friends
        /// </summary>
        /// <returns>Deep copy of Friends List</returns>
        public List<string> GetFriends()
        {
            List<string> friendList = new List<string>();
            foreach (string friend in Friends)
                friendList.Add(friend);

            return friendList;
        }

        /// <summary>
        /// Transforms Friends list into a string seperated by spaces
        /// </summary>
        /// <returns>string of all friends</returns>
        public string GetFriendsString() => String.Join(" ", Friends);

        /// <summary>
```

```
        /// ToString Override
        /// </summary>
        /// <returns>string version of the object: Name, Friend Count, Friends</returns>
        public override string ToString()
        {
            return $"{Name,-20}|{Friends.Count,20}|{GetFriendsString()}";
        }
    }
}
```

WebForm1.aspx:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="WebForm1.aspx.cs"
Inherits="Lab01.WebForm1" %>

<!DOCTYPE html>

<html xmlns="http://www.w3.org/1999/xhtml">
<head runat="server">
    <title></title>
</head>
<body>
    <form id="form1" runat="server">
        <div>
            <asp:Label ID="HeaderLabel" runat="server" Text="Lab01-16"></asp:Label>
            <br />
            <br />
            <asp:Label ID="StudentLabel" runat="server" Text="Studentų
duomenys:"></asp:Label>
            <br />
            <asp:Table ID="StudentTable" runat="server">
            </asp:Table>
            <br />
            <asp:Label ID="ConnectionLabel" runat="server" Text="Studentų Ieškomi
Junginiai:"></asp:Label>
            <br />
            <asp:Table ID="ConnectionTable" runat="server">
            </asp:Table>
            <br />
            <asp:Label ID="OutputLabel" runat="server" Text="Rezultatai:"></asp:Label>
            <br />
            <asp:Table ID="PathTable" runat="server">
            </asp:Table>
        </div>
    </form>
</body>
</html>
```

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;

namespace Lab01
{
    public partial class WebForm1 : System.Web.UI.Page
    {
        private string studentInput = @"App_Data/students.txt";
        private string connectionInput = @"App_Data/connections.txt";
        private string initialDataPath = @"App_Data/initial_data.txt";
        private string outputDataPath = @"App_Data/result.txt";
```

```
        private Dictionary<string, Student> students;
        private List<Tuple<string, string>> connectionList;
        protected void Page_Load(object sender, EventArgs e)
        {
            // Initial Data
            InOutUtils.CreateFile(Server.MapPath(initialDataPath));
            students = InOutUtils.ReadStudents(Server.MapPath(studentInput));

            FillTableWithStudents(new List<Student>(students.Values),
                                  StudentTable);

            InOutUtils.AppendInitStudents(new List<Student>(students.Values),
                                          Server.MapPath(initialDataPath));

            connectionList = InOutUtils.ReadConnections(Server.MapPath(connectionInput));

            FillTableWithConnections(connectionList,
                                     ConnectionTable);

            InOutUtils.AppendInitData(connectionList,
                                     Server.MapPath(initialDataPath));


            FillPathTable(students, connectionList, PathTable);
            InOutUtils.CreateFile(Server.MapPath(outputDataPath));

            InOutUtils.AppendConnectionResults(students,
                                               connectionList,
                                               Server.MapPath(outputDataPath));

        }

        /// <summary>
        /// Used to show initial Student Data
        /// </summary>
        /// <param name="students">List Student data type</param>
        /// <param name="table">Table Object data type</param>
        protected void FillTableWithStudents(List<Student> students, Table table)
        {
            TableRow row = new TableRow();
            row.Cells.Add(CreateCell("Studentas"));
            row.Cells.Add(CreateCell("Draugų Kiekis"));
            row.Cells.Add(CreateCell("Studentų Draugai:"));
            table.Rows.Add(row);

            foreach (Student student in students)
            {
                row = new TableRow();
                row.Cells.Add(CreateCell(student.Name));
                row.Cells.Add(CreateCell(student.FriendCount.ToString()));
                row.Cells.Add(CreateCell(student.GetFriendsString()));
                table.Rows.Add(row);

            }
        }

        /// <summary>
        /// Used to show initial connection data
        /// </summary>
        /// <param name="connections">List of Tuples compromised of string, string
containing the initial node and end node to use for DFS</param>
        /// <param name="table">Table object data type</param>
        protected void FillTableWithConnections(List<Tuple<string,
                                                           string>> connections,
                                                Table table)
        {
            TableRow row = new TableRow();
```

```
            row.Cells.Add(CreateCell("Draugas"));
            row.Cells.Add(CreateCell("Ieškomas Draugas"));
            table.Rows.Add(row);

            foreach (Tuple<string, string> connection in connections)
            {
                row = new TableRow();
                row.Cells.Add(CreateCell(connection.Item1));
                row.Cells.Add(CreateCell(connection.Item2));
                table.Rows.Add(row);

            }
        }

        /// <summary>
        /// Creates A cell with provided Text
        /// </summary>
        /// <param name="text">text to be added to the Cell.text param</param>
        /// <returns>TableCell object</returns>
        protected TableCell CreateCell(string text)
        {
            TableCell cell = new TableCell();
            cell.Style.Add("padding", "5px");
            cell.Text = text;
            return cell;
        }

        /// <summary>
        /// Fills the table with paths from student a to b
        /// </summary>
        /// <param name="students"> Dictionary, key -> string of the student, value ->
student object</param>
        /// <param name="connections">List of Tuples compromised of string, string
containing the initial node and end node to use for DFS</param>
        /// <param name="table">Table object where the data will be added</param>
        protected void FillPathTable(Dictionary<string, Student> students,
                                     List<Tuple<string, string>> connections,
                                     Table table)
        {
            TableRow row = new TableRow();
            row.Cells.Add(CreateCell("Draugas"));
            row.Cells.Add(CreateCell("Ieškomas Draugas"));
            row.Cells.Add(CreateCell("Kelias: "));
            table.Rows.Add(row);

            foreach (Tuple<string, string> connection in connections)
            {
                List<string> path = new List<string>();
                path.Add(connection.Item1);
                path = TaskUtils.FindConnection(connection.Item1,
                                                connection.Item2,
                                                path, students);

                string pathText = TaskUtils.CreatePathText(path);

                row = new TableRow();
                row.Cells.Add(CreateCell(connection.Item1));
                row.Cells.Add(CreateCell(connection.Item2));
                row.Cells.Add(CreateCell(pathText));
                table.Rows.Add(row);

            }
        }
    }
}
```

1.7. Pradiniai duomenys ir rezultatai

```
Pradiniai Duomenys 1:

students.txt:

Rūta 1 Arnoldas
Agnė 3 Nerijus Neda Antanas
Nerijus 1 Agnė
Antanas 2 Agnė Marius
Marius 2 Antanas Neda
Neda 3 Marius Rūta Agnė
Arnoldas 1 Rūta

connections.txt:

Rūta Nerijus
Agnė Antanas
Neda Nerijus

Rezultatai 1:
```

Vartotojo sąsaja:

Lab01-16

Studentų duomenys:

Studentas	Draugų Kiekis	Studentų Draugai:
Rūta	1	Arnoldas
Agnė	3	Nerijus Neda Antanas
Nerijus	1	Agnė
Antanas	2	Agnė Marius
Marius	2	Antanas Neda
Neda	3	Marius Rūta Agnė
Arnoldas	1	Rūta

Studentų Ieškomi Junginiai:

Draugas	Ieškomas Draugas
Rūta	Nerijus
Agnė	Antanas
Neda	Nerijus

Rezultatai:

Draugas	Ieškomas Draugas	Kelias:
Rūta	Nerijus	negali susipažinti
Agnė	Antanas	jau pažįstami
Neda	Nerijus	bendri pažįstami: Agnė

initial_data.txt:

```
Studentai ir jų draugai
Studentas           |Draugų kiekis       |Draugai:
Rūta                |                   1|Arnoldas
Agnė                |                   3|Nerijus Neda Antanas
Nerijus             |                   1|Agnė
Antanas             |                   2|Agnė Marius
Marius              |                   2|Antanas Neda
Neda                |                   3|Marius Rūta Agnė
Arnoldas            |                   1|Rūta

Studentai ir jų ieškomi draugai:
Studentas            Ieškomas draugas
Rūta                 Nerijus
Agnė                 Antanas
Neda                 Nerijus
```

Result.txt:

Draugai ir jų junginiai, bei keliai:

Draugas	Ieškomas draugas:	Kelias:
Rūta	Nerijus	negali susipažinti
Agnė	Antanas	jau pažįstami
Neda	Nerijus	bendri pažįstami: Agnė

Pradiniai Duomenys 2:

students.txt:

```
a 2 g b
b 2 a c
c 2 b f
d 1 e
e 1 d
f 2 h c
g 2 a h
h 2 g f
```

connections.txt:

```
a f
a b
a e
```

Rezultatai 2:

Vartotojo Sąsaja:

Lab01-16

Studentų duomenys:

Studentas	Draugų Kiekis	Studentų Draugai:
a	2	g b
b	2	a c
c	2	b f
d	1	e
e	1	d
f	2	h c
g	2	a h
h	2	g f

Studentų Ieškomi Junginiai:

Draugas	Ieškomas Draugas
a	f
a	b
a	e

Rezultatai:

Draugas	Ieškomas Draugas	Kelias:
a	f	bendri pažįstami: g h
a	b	jau pažįstami
a	e	negali susipažinti

```
Initial_data.txt:

Studentai ir jų draugai
Studentas           |Draugų kiekis       |Draugai:
a                   |                   2|g b
b                   |                   2|a c
c                   |                   2|b f
d                   |                   1|e
e                   |                   1|d
f                   |                   2|h c
g                   |                   2|a h
h                   |                   2|g f

Studentai ir jų ieškomi draugai:
Studentas            Ieškomas draugas
a                    f
a                    b
a                    e

result.txt:

Draugai ir jų junginiai, bei keliai:
Draugas             |Ieškomas draugas:   |Kelias:
a                   |f                   |bendri pažįstami: g h
a                   |b                   |jau pažįstami
a                   |e                   |negali susipažinti
```

1.8. Dėstytojo pastabos

1. Reiktų šiek tiek pakeisti ataskaitos įvardinimą. Jūsų grupė nėra IFF14.

2. Klasių diagramai vien tik Visual Studio įrankio neužtenka. Jis ne neatskleidžia pilnai klasės vidaus.

3. Garmatinės klaidos "su duotą ir apskaičiuotą "

4. • Įvedimo ir išvedimo metodus, veikiančius su tekstiniu failu, talpinkite į public static class InOutUtils.

5. Parametrus reikia komentuoti visiems metodams // /// appends students to TXT file /// public static void AppendInitialStudentData(List students, string path)

6. Čia tik rodyklės perrašymas:

public Student(string name, List friends)

{

Name = name;

Friends = friends;

2. Dinaminis atminties valdymas (L2)

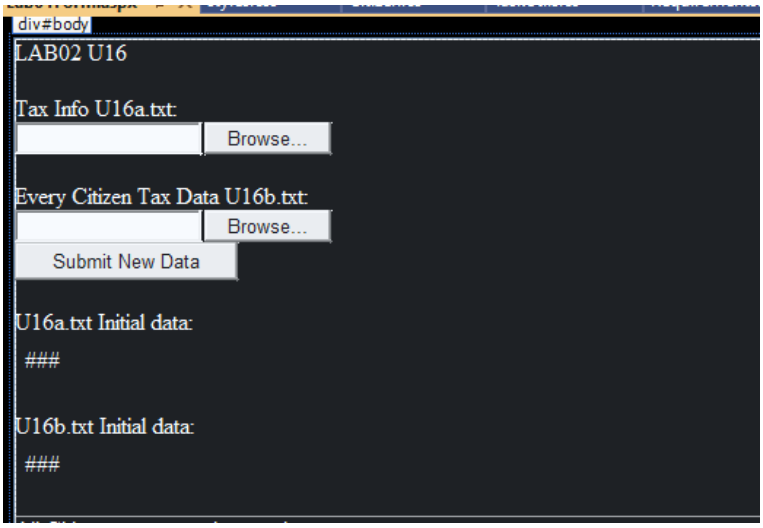
2.1. Darbo užduotis

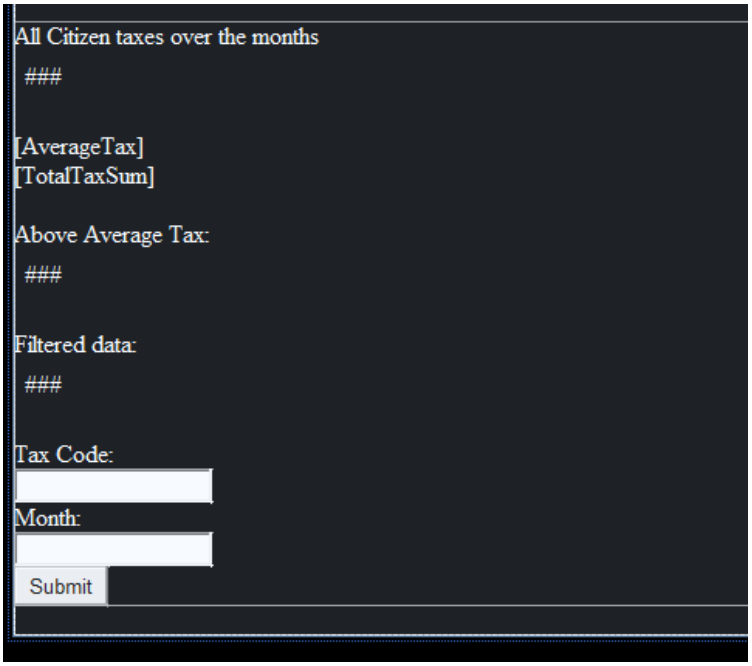
LD_16. **Mokesčiai**. Kiekvieną mėnesį gyventojai moka komunalinius mokesčius. Suraskite, kurį mėnesį ir kokie komunaliniai mokesčiai kainavo pigiausiai. Apskaičiuokite, kokią pinigų sumą komunaliniams mokesčiams išleido visi gyventojai. Sudarykite sąrašą gyventojų (pavardė ir vardas, adresas), kurie už komunalines paslaugas per metus mokėjo sumą, mažesnę už vidutinę. Sąrašas turi būti surikiuotas pagal gyventojų adresus, pavardes ir vardus abėcėlės tvarka.
Duomenys:

- tekstiniame faile U16a.txt yra informacija apie komunalines paslaugas: paslaugos kodas, paslaugos pavadinimas, paslaugos vieno mėnesio vieno vieneto kaina;
- tekstiniame faile U16b.txt yra informacija apie gyventojus: pavardė ir vardas, adresas, mėnuo už kurį mokama, komunalinės paslaugos kodas, sunaudotų per mėnesį vienetų kiekis.

Pašalinkite iš sąrašo gyventojus, kurie nemokėjo už nurodytą paslaugą, nurodytą mėnesį (duomenys įvedami klaviatūra).

2.2. Grafinės vartotojo sąsajos schema

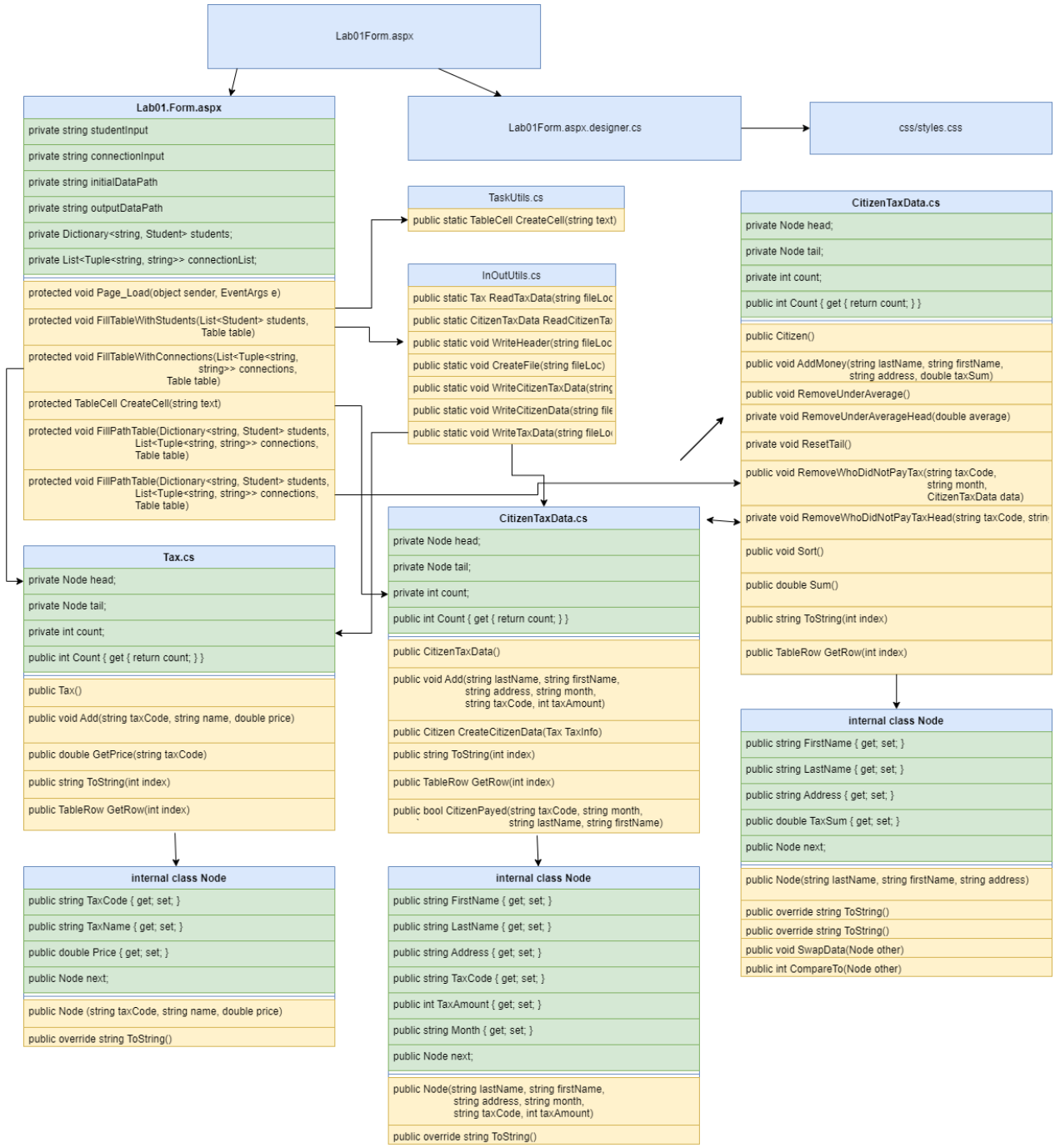




2.3. Sąsajoje panaudotų komponentų keičiamos savybės

Komponentas	Savybė	Reikšmė
HeaderLabel	Text	LAB02 U16
Label1	Text	Tax InfoU16a.txt:
Label2	Text	Every Citizen Tax Data U16b:
InitTaxLabel	Text	U16a.txt Initial data:
InitCitizenLabel	Text	U16b.txt Initial data:
CitizenTaxLabel	Text	All Citizen taxes over the months
AverageTax	Text	“”
TotalTaxSum	Text	“”
CitizenTaxLabel0	Text	Above Average Tax:
FilterData	Text	Filtered data:
ButtonFilter	Text	Tax Code:
DataButton	Text	Month:

2.4. Klasių diagrama



2.5. Programos vartotojo vadovas

Jeigu neranda failų visų duombazėje, programa paprašo failų. Jeigu randa tik vieną pradinį failą, rodo tik jį ir prašo likusių failų. Kai abu failai atsiranda duombazėje, užkrauna skaičiavimus. Apskaičiuoja vidutinę mokesčių kainą, sumą visų ir individualių žmonių. Tekstas yra rikiuojamas A-Z pagal: adresą, pavardę, vardą. Kodas leidžia filtruoti žmones, kurie mokėjo nurodytą mėnesį (mėnuo yra string) už nurodytus mokesčius naudojant „Tax Code“ (string). Prie filtered lentelės prideda tik filtruotus duomenis.

2.6. Programos tekstas

Tax.cs:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI.WebControls;

namespace Lab02
{
    public class Tax
    {
        private Node head;
        private Node tail;
        private int count;
        public int Count { get { return count; } }

        public Tax()
        {
            head = null;
            tail = null;
            count = 0;
        }
        /// <summary>
        /// Adds Node to the tail of the LinkedList
        /// </summary>
        /// <param name="taxCode">Code of the tax</param>
        /// <param name="name"> name of the company</param>
        /// <param name="price">price of a single use</param>
        public void Add(string taxCode, string name, double price)
        {
            if (head == null)
            {
                head = new Node(taxCode, name, price);
                tail = head;
                count++;
            }
            else
            {
                tail.next = new Node(taxCode, name, price);
                tail = tail.next;
                count++;

            }

        }

        /// <summary>
        /// Returns the price of the tax of a single use
        /// </summary>
        /// <param name="taxCode">Code to identify the type of tax</param>
        /// <returns>Double, price of a single use tax item</returns>
        public double GetPrice(string taxCode)
        {
            Node curr = head;
            while (curr != null)
            {
                if (curr.TaxCode == taxCode)
                    return curr.Price;
                curr = curr.next;
            }
```

```
    return 0;
}

/// <summary>
/// Returns string format of Tax Node
/// </summary>
/// <param name="index">index of the node in Tax Linked List</param>
/// <returns>string format of the specified Node</returns>
public string ToString(int index)
{
    int i = 0;
    for(Node curr = head; curr != null; curr = curr.next)
    {
        if (i == index)
            return curr.ToString();
        i++;
    }
    return "";
}

/// <summary>
/// Returns Tax Node in TableRow format
/// </summary>
/// <param name="index">Index of the  Linked List node</param>
/// <returns>Returns Node with specified index in TableRow format</returns>
public TableRow GetRow(int index)
{
    int i = 0;
    TableRow row = new TableRow();
    for (Node curr = head; curr != null; curr = curr.next)
    {
        if (i == index)
        {
            row.Cells.Add(TaskUtils.CreateCell(curr.TaxCode));
            row.Cells.Add(TaskUtils.CreateCell(curr.TaxName));
            row.Cells.Add(TaskUtils.CreateCell(curr.Price.ToString()));
            return row;
        }
        i++;
    }
    return row;
}

/// <summary>
/// Tax Node
/// </summary>
internal class Node
{
    public string TaxCode { get; set; }
    public string TaxName { get; set; }
    public double Price { get; set; }
    public Node next;

    /// <summary>
    /// Constructor
    /// </summary>
    /// <param name="taxCode">Code of the tax</param>
    /// <param name="name">name of the compnay</param>
    /// <param name="price">price of a single use</param>
    public Node (string taxCode, string name, double price)
    {
        TaxCode = taxCode;
        TaxName = name;
        Price = price;
        next = null;
    }
```

```
            /// <summary>
            /// Returns Node in string format
            /// </summary>
            /// <returns>Node in string format</returns>
            public override string ToString()
            {
                return $"{TaxCode,-20}|{TaxName,-20}|{Price,10:f}|";
            }

        }
    }
}
```

CitizenTaxData.cs:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI.WebControls;

namespace Lab02
{
    /// <summary>
    /// Citizen class object meant to store name and how much the individual payed for
taxe
    /// </summary>
    public class CitizenTaxData
    {
        private Node head;
        private Node tail;
        private int count;
        public int Count { get { return count; } }

        /// <summary>
        /// Constructor
        /// </summary>
        public CitizenTaxData()
        {
            head = null;
            tail = null;
            count = 0;
        }
        /// <summary>
        /// Adds element to Linked List
        /// </summary>
        /// <param name="lastName">Last Name</param>
        /// <param name="firstName">First Name</param>
        /// <param name="address">Address</param>
        /// <param name="month">Month</param>
        /// <param name="taxCode">Tax Code</param>
        /// <param name="taxAmount">Tax Amount</param>
        public void Add(string lastName, string firstName, string address, string month,
string taxCode, int taxAmount)
        {
            count++;
            if (head == null)
            {
                head = new Node(lastName, firstName, address, month, taxCode, taxAmount);
                tail = head;

            }
            else
            {
                tail.next = new Node(lastName, firstName, address, month, taxCode,
taxAmount);
                tail = tail.next;
            }

        }
        /// <summary>
        /// Creates Citizen class object using Tax object
        /// </summary>
        /// <param name="TaxInfo">Tax class object</param>
        /// <returns>Citizen class object</returns>
        public Citizen CreateCitizenData(Tax TaxInfo)
        {
            Citizen citizens = new Citizen();
            for (Node curr = head; curr != null; curr = curr.next)
```

```
            {
                citizens.AddMoney(curr.LastName, curr.FirstName, curr.Address,
(double)TaxInfo.GetPrice(curr.TaxCode) * curr.TaxAmount);
            }
            return citizens;
        }

        /// <summary>
        /// Returns string format using index
        /// </summary>
        /// <param name="index">index of CitizenTaxData Node element</param>
        /// <returns>string format of CitizenTaxData</returns>
        public string ToString(int index)
        {
            int i = 0;
            for (Node curr = head; curr != null; curr = curr.next)
            {
                if (i == index)
                    return curr.ToString();
                i++;
            }
            return "";
        }

        /// <summary>
        /// Returns CitizenTaxData specified element in TableRow format
        /// </summary>
        /// <param name="index">index of the Node element</param>
        /// <returns>TableRow of the specified Node</returns>
        public TableRow GetRow(int index)
        {
            int i = 0;
            TableRow row = new TableRow();
            for (Node curr = head; curr != null; curr = curr.next)
            {
                if (i == index)
                {
                    row.Cells.Add(TaskUtils.CreateCell(curr.LastName));
                    row.Cells.Add(TaskUtils.CreateCell(curr.FirstName));
                    row.Cells.Add(TaskUtils.CreateCell(curr.Address));
                    row.Cells.Add(TaskUtils.CreateCell(curr.Month));
                    row.Cells.Add(TaskUtils.CreateCell(curr.TaxCode));
                    row.Cells.Add(TaskUtils.CreateCell(curr.TaxAmount.ToString()));
                    return row;
                }
                i++;
            }
            return row;
        }

        /// <summary>
        /// Checks of the specified citizen has payed
        /// </summary>
        /// <param name="taxCode">Tax Code of the Tax Company</param>
        /// <param name="month">Month</param>
        /// <param name="lastName">Last name of the citizen</param>
        /// <param name="firstName"> First Name of the citizen</param>
        /// <returns>true if citizen has payed for specified tax on specified month,
false if the citizen did not</returns>
        public bool CitizenPayed(string taxCode, string month, string lastName, string
firstName)
        {
            Node curr = head;
            while(curr != null)
            {
                if (curr.LastName == lastName && curr.FirstName == firstName &&
curr.Month == month && curr.TaxCode == taxCode)
```

```
                    return true; // The Person paid for the month

                curr = curr.next;
            }
            return false;
        }

        /// <summary>
        /// Node class object for CitizenTaxData
        /// </summary>
        internal class Node
        {
            public string FirstName { get; set; }
            public string LastName { get; set; }
            public string Address { get; set; }
            public string TaxCode { get; set; }
            public int TaxAmount { get; set; }
            public string Month { get; set; }

            public Node next;
            /// <summary>
            /// Node of CitizenTaxData LinkedList
            /// </summary>
            /// <param name="lastName">Last Name</param>
            /// <param name="firstName">First Name</param>
            /// <param name="address">Address of the specified Citizen</param>
            /// <param name="month">Time of Month when the specified tax was
payed</param>
            /// <param name="taxCode">TaxCode of the tax</param>
            /// <param name="taxAmount">how much tax units did the citizen use</param>
            public Node(string lastName, string firstName, string address, string month,
string taxCode, int taxAmount)
            {
                LastName = lastName;
                FirstName = firstName;
                Address = address;
                Month = month;
                TaxCode = taxCode;
                TaxAmount = taxAmount;
            }

            /// <summary>
            /// ToString format of the node
            /// </summary>
            /// <returns>string format of CitizenTaxData Node</returns>
            public override string ToString()
            {
                return $"{LastName,-20} {FirstName,-20}|{Address, -20}|{Month, -
15}|{TaxCode, -20}|{TaxAmount,10}|";
            }
        }
    }
}
```

Citizen.cs:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI.WebControls;

namespace Lab02
{
    /// <summary>
```

```
    /// Citizen class object
    /// </summary>
    public class Citizen
    {
        private Node head;
        private Node tail;
        private int count;
        public int Count { get { return count; } }

        /// <summary>
        /// Constructor
        /// </summary>
        public Citizen()
        {
            head = null;
            tail = null;
            count = 0;
        }
        /// <summary>
        /// Adds money to the specified citizen using his FirstName and Last name.
        /// If the citizen does not exists, adds him to the LinkedList
        /// </summary>
        /// <param name="lastName">Last name of the citizen</param>
        /// <param name="firstName">FIrst name of the citizn</param>
        /// <param name="address">address of the citizen</param>
        /// <param name="taxSum">Tax sum to add to his TOTAL</param>
        public void AddMoney(string lastName, string firstName, string address, double
taxSum)
        {
            // If Citizen exists, adds sum to his current balance
            for (Node curr = head; curr != null; curr = curr.next)
            {
                if (curr.LastName == lastName && curr.FirstName == firstName)
                {
                    curr.TaxSum += taxSum;
                    return;
                }
            }

            // If No citizen was found, adds the citizen to Linked List
            count++;
            if (head == null)
            {
                head = new Node(lastName, firstName, address);
                head.TaxSum = taxSum;
                tail = head;
            }
            else
            {
                tail.next = new Node(lastName, firstName, address);
                tail = tail.next;
                tail.TaxSum = taxSum;
            }

        }

        /// <summary>
        /// Removes citiznens from linked list who payed belove average taxes
        /// </summary>
        public void RemoveUnderAverage()
        {
            if (count == 0)
                return;

            Node prev = head;
            Node curr = head.next;
            double average = GetAverage();
```

```
            while(curr != null)
            {
                if(curr.TaxSum < average)
                {
                    prev.next = curr.next;
                    curr = curr.next;
                    count--;
                }
                else
                {
                    curr = curr.next;
                    prev = prev.next;
                }
            }

            RemoveUnderAverageHead(average);
            ResetTail();
        }

        /// <summary>
        /// Checks if head/start of linked list is below average. If true removes
        /// </summary>
        /// <param name="average">Average tax sum of a citizen</param>
        private void RemoveUnderAverageHead(double average)
        {
            Node curr = head;
            while(curr.TaxSum < average)
            {
                curr = curr.next;
                count--;
            }
            head = curr;
        }

        /// <summary>
        /// Resets tail after removing elements
        /// </summary>
        private void ResetTail()
        {
            Node curr = head;
            if (curr == null)
            {
                tail = null;
                count = 0;
                return;
            }

            while(curr.next != null)
            {
                curr = curr.next;
            }
            tail = curr;
        }

        /// <summary>
        /// Removes citizens who did not pay taxes specified month
        /// </summary>
        /// <param name="taxCode"> Tax Code of the tax</param>
        /// <param name="month">Specified Month </param>
        /// <param name="data">CitizenTaxData to see what citizen payed what tax at the
specified month</param>
        public void RemoveWhoDidNotPayTax(string taxCode, string month, CitizenTaxData
data)
        {
            {
                if (count == 0)
```

```
                    return;

                Node prev = head;
                Node curr = head.next;

                while (curr != null)
                {
                    // Checks if the citizen has payed Taxes in CitizenTaxData on
specified Month
                    if (curr != null && data.CitizenPayed(taxCode, month, curr.LastName,
curr.FirstName) == false)
                    {


prev.next = curr.next;
                        curr = curr.next;
                        count--;
                    }
                    else
                    {
                        curr = curr.next;
                        prev = prev.next;
                    }
                }

                RemoveWhoDidNotPayTaxHead(taxCode, month, data);
                ResetTail();
            }
        }

        /// <summary>
        /// Checks first/start/head element of the linked list if the tax was paid
        /// </summary>
        /// <param name="taxCode">Tax code of the specified tax</param>
        /// <param name="month">specified month to check</param>
        /// <param name="data">CitizenTaxData to check if the first element of the linked
list payed for taxes</param>
        private void RemoveWhoDidNotPayTaxHead(string taxCode, string month,
CitizenTaxData data)
        {
            Node curr = head;
            // Checks if the citizen has payed Taxes in CitizenTaxData on specified Month
            while (curr != null && data.CitizenPayed(taxCode, month, curr.LastName,
curr.FirstName) == false)
            {
                curr = curr.next;
                count--;
            }
            head = curr;
        }

            public double GetAverage()
        {
            return count > 0 ? (double)Sum() / count : 0;
        }

        /// <summary>
        /// Sorts LinkedList A-Z using keys: address, last name, first name. Does data
swap instead of pointers.
        /// </summary>
        public void Sort()
        {
            if (count > 1)
            {
                for (int i = 0; i < count; i++)
                {
                    Node curr = head;
```

```
            Node next = head.next;
            for (int j = 0; j < count - 1 - i; j++)
            {
                if (curr.CompareTo(next) > 0)
                {
                    curr.SwapData(next);
                }
                curr = next;
                next = next.next;
            }
        }
    }
}

/// <summary>
/// Returns the total amount citizens payed for taxes
/// </summary>
/// <returns></returns>
public double Sum()
{
    Node curr = head;
    double sum = 0;
    while (curr != null)
    {
        sum += curr.TaxSum;
        curr = curr.next;
    }
    return sum;
}

/// <summary>
/// Returns citizen in string format
/// </summary>
/// <param name="index"> specified citizen</param>
/// <returns>string format of the citizen for .txt output</returns>
public string ToString(int index)
{
    int i = 0;
    for (Node curr = head; curr != null; curr = curr.next)
    {
        if (i == index)
            return curr.ToString();
        i++;
    }
    return "";
}


/// <summary>
/// Returns cictizen in TableRow format for the specified citizen
/// </summary>
/// <param name="index">Index of the citizen</param>
/// <returns>TableRow format of the specified citizen</returns>
public TableRow GetRow(int index)
{
    int i = 0;
    TableRow row = new TableRow();
    for (Node curr = head; curr != null; curr = curr.next)
    {
        if (i == index)
        {
            row.Cells.Add(TaskUtils.CreateCell(curr.LastName));
            row.Cells.Add(TaskUtils.CreateCell(curr.FirstName));
            row.Cells.Add(TaskUtils.CreateCell(curr.Address));
            row.Cells.Add(TaskUtils.CreateCell(curr.TaxSum.ToString()));
            return row;
        }
```

```
            i++;
        }
        return row;
    }

    /// <summary>
    /// Node class to be used to save every citizen seperately
    /// </summary>
    internal class Node
    {
        public string FirstName { get; set; }
        public string LastName { get; set; }
        public string Address { get; set; }

        public double TaxSum { get; set; }

        public Node next;
        /// <summary>
        /// Constructor
        /// </summary>
        /// <param name="lastName">Last name of the citizen</param>
        /// <param name="firstName">First Name of the citizen</param>
        /// <param name="address">Address of the citizen</param>
        public Node(string lastName, string firstName, string address)
        {
            LastName = lastName;
            FirstName = firstName;
            Address = address;
            TaxSum = 0;
        }

        /// <summary>
        /// To String override
        /// </summary>
        /// <returns>stringg format of the citizen</returns>
        public override string ToString()
        {
            return $"{LastName,-20} {FirstName,-20}|{Address,-20}|{TaxSum,10:f}|";
        }

        /// <summary>
        /// Swaps the DATA, keeps the pointers
        /// </summary>
        /// <param name="other">Other node to be swapped with</param>
        public void SwapData(Node other)
        {
            string lastName = LastName;
            string firstName = FirstName;
            string address = Address;
            double taxSum = TaxSum;
            LastName = other.LastName;
            FirstName = other.FirstName;
            Address = other.Address;
            TaxSum = other.TaxSum;
            other.LastName = lastName;
            other.FirstName = firstName;
            other.Address = address;
            other.TaxSum = taxSum;
        }

        /// <summary>
        /// Compares to other Node of citizen type
        /// </summary>
        /// <param name="other"></param>
        /// <returns></returns>
        public int CompareTo(Node other)
        {
```

```
                int comparison = other.Address.CompareTo(Address);
                if (comparison == 0 )
                {
                    comparison = other.LastName.CompareTo(LastName);
                    if (comparison == 0)
                    {
                        comparison = other.FirstName.CompareTo(FirstName);
                    }
                }

                return comparison;
            }
        }
    }
}
```

InOutUtils.cs:

```
using System;
using System.Collections.Generic;
using System.IO;
using System.Linq;
using System.Web;

namespace Lab02
{
    /// <summary>
    /// Static InOutUtils helper class for Input/Output with files
    /// </summary>
    public static class InOutUtils
    {
        /// <summary>
        /// Reads Tax Data from txt to Tax class object+
        /// </summary>
        /// <param name="fileLoc">Location of the data in .txt format</param>
        /// <returns>Tax class object</returns>
        public static Tax ReadTaxData(string fileLoc)
        {
            Tax TaxData = new Tax();
            string[] lines = File.ReadAllLines(fileLoc);
            foreach (string line in lines)
            {
                string[] elements = line.Split(';');
                TaxData.Add(elements[0], elements[1], double.Parse(elements[2]));
            }
            return TaxData;
        }

        /// <summary>
        /// Creates CitizenTaxData from .txt file
        /// </summary>
        /// <param name="fileLoc">Location of .txt file</param>
        /// <returns>CitizenTaxData class object</returns>
        public static CitizenTaxData ReadCitizenTaxData(string fileLoc)
        {
            CitizenTaxData data = new CitizenTaxData();
            string[] lines = File.ReadAllLines(fileLoc);
            foreach (string line in lines)
            {
                string[] elements = line.Split(';');
                data.Add(elements[0], elements[1], elements[2], elements[3], elements[4],
int.Parse(elements[5]));
            }
            return data;
        }
```

```
        /// <summary>
        /// Appends a header to a file
        /// </summary>
        /// <param name="fileLoc">Name/location of the file</param>
        /// <param name="header">text to be appended</param>
        public static void WriteHeader(string fileLoc, string header)
        {
            using (StreamWriter writer = new StreamWriter(fileLoc, append: true))
            {
                writer.WriteLine(header);
                writer.WriteLine();
            }
        }

        /// <summary>
        /// Creates a new or wipes a file
        /// </summary>
        /// <param name="fileLoc">Location of the file</param>
        public static void CreateFile(string fileLoc)
        {
            using (FileStream fs = new FileStream(fileLoc, FileMode.Create))
                new StreamWriter(fs, encoding: System.Text.Encoding.UTF8).Close();
        }

        /// <summary>
        /// Appends CitizenTaxData to a file
        /// </summary>
        /// <param name="fileLoc">Location/name of the file</param>
        /// <param name="data">data to append to the .txt file</param>
        /// <param name="header">Header text of the data file</param>
        public static void WriteCitizenTaxData(string fileLoc, CitizenTaxData data,
string header)
        {
            using (StreamWriter writer = new StreamWriter(fileLoc, append:true))
            {
                writer.WriteLine(header);
                writer.WriteLine();
                writer.WriteLine($"{"LastName",-20} {"FirstName",-20}|{"Address",-
20}|{"Month",-15}|{"TaxCode",-20}|{"TaxAmount",10}|");
                for (int i = 0; i < data.Count; i++)
                {
                    writer.WriteLine(data.ToString(i));
                }
                writer.WriteLine();
            }
        }

        /// <summary>
        /// appends Citizen class object data to text file
        /// </summary>
        /// <param name="fileLoc">location/name of the file</param>
        /// <param name="data">data to append to the file</param>
        /// <param name="header">Header of the file</param>
        public static void WriteCitizenData(string fileLoc, Citizen data, string header)
        {
            using (StreamWriter writer = new StreamWriter(fileLoc, append: true))
            {
                writer.WriteLine(header);
                writer.WriteLine();
                writer.WriteLine($"{"LastName",-20} {"FirstName",-20}|{"Address",-
20}|{"TaxSum",-10}|");
                for (int i = 0; i < data.Count; i++)
                {
                    writer.WriteLine(data.ToString(i));
                }
                writer.WriteLine();
```

```
            }
        }

        /// <summary>
        /// Appends Tax data to a .txt file
        /// </summary>
        /// <param name="fileLoc">Location/name of the file</param>
        /// <param name="data">data to append to the .txt file</param>
        /// <param name="header">header to be added to the file</param>
        public static void WriteTaxData(string fileLoc, Tax data, string header)
        {
            using (StreamWriter writer = new StreamWriter(fileLoc, append: true))
            {
                writer.WriteLine(header);
                writer.WriteLine();
                writer.WriteLine($"{"TaxCode",-20}|{"TaxName",-20}|{"Price",10:2f}|");
                for (int i = 0; i < data.Count; i++)
                {
                    writer.WriteLine(data.ToString(i));
                }
                writer.WriteLine();
            }
        }
    }
}
```

TaskUtils.cs:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI.WebControls;

namespace Lab02
{
    /// <summary>
    /// TaskUtils static class for helper functions
    /// </summary>
    public static class TaskUtils
    {
        /// <summary>
        /// Creates TableCell from text to speed up TableCell creation
        /// </summary>
        /// <param name="text">string text to add to the table cell</param>
        /// <returns>TableCell class object</returns>
        public static TableCell CreateCell(string text)
        {
            TableCell cell = new TableCell();
            cell.Text = text;
            return cell;
        }
    }
}
```

css/styles.css:

```
body {
    color:white;
    background:black;
}
td
{
    padding:5px;
```

```
}
```

Lab01Form.aspx:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Lab01Form.aspx.cs"
Inherits="Lab02.Lab01Form" %>

<!DOCTYPE html>

<html xmlns="http://www.w3.org/1999/xhtml">
<head runat="server">
    <link rel="stylesheet" runat="server" media="screen" href="~/css/styles.css" />
    <title>Lab02 U16</title>
</head>
<body>
    <form id="form1" runat="server">
        <div id="body">
            <asp:Label ID="HeaderLabel" runat="server" Text="LAB02 U16"></asp:Label>
            <br />
            <br />
            <asp:Label ID="Label1" runat="server" Text="Tax Info U16a.txt:"></asp:Label>
            <br />
            <asp:FileUpload ID="FileUpload1" runat="server" />
            <br />
            <br />
            <asp:Label ID="Label2" runat="server" Text="Every Citizen Tax Data U16b.txt:
"></asp:Label>
            <br />
            <asp:FileUpload ID="FileUpload2" runat="server" />
            <br />
            <asp:Button ID="DataButton" runat="server" Text="Submit New Data"
OnClick="DataButton_Click" />
            <br />
            <br />
            <asp:Label ID="InitTaxLabel" runat="server" Text="U16a.txt Initial
data:"></asp:Label>
            <asp:Table ID="InitTaxTable" runat="server">
            </asp:Table>
            <br />
            <asp:Label ID="InitCitizenLabel" runat="server" Text="U16b.txt Initial
data:"></asp:Label>
            <asp:Table ID="InitCitizenTable" runat="server">
            </asp:Table>
            <br />
            <asp:Panel ID="CalculationsPanel" runat="server">
                <asp:Label ID="CitizenTaxLabel" runat="server" Text="All Citizen taxes
over the months"></asp:Label>
                <asp:Table ID="CitizenTaxTable" runat="server">
                </asp:Table>
                <br />
                <asp:Label ID="AverageTax" runat="server"></asp:Label>
                <br />
                <asp:Label ID="TotalTaxSum" runat="server"></asp:Label>
                <br />
                <br />
                <asp:Label ID="CitizenTaxLabel0" runat="server" Text="Above Average
Tax:"></asp:Label>
                <asp:Table ID="AboveAverageTable" runat="server">
                </asp:Table>
                <br />
                <asp:Label ID="FilterData" runat="server" Text="Filtered
data:"></asp:Label>
                <asp:Table ID="FilterTable" runat="server">
                </asp:Table>
                <br />
                Tax Code:<br />
                <asp:TextBox ID="TaxCodeTextBox" runat="server"></asp:TextBox>
                <br />
```

```
                Month:<br />
                <asp:TextBox ID="TaxMonthTextBox" runat="server"></asp:TextBox>
                <br />
                <asp:Button ID="ButtonFilter" runat="server" Text="Submit"
OnClick="ButtonFilter_Click" />
            </asp:Panel>
            <br />
        </div>
    </form>
</body>
</html>


using System;
using System.Collections.Generic;
using System.IO;
using System.Linq;
using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;

namespace Lab02
{
    public partial class Lab01Form : System.Web.UI.Page
    {
        private string taxDataInput = @"App_Data/U16a.txt";
        private string citizenDataInput = @"App_Data/U16b.txt";
        private string outputDataPath = @"App_Data/U16result.txt";
        protected void Page_Load(object sender, EventArgs e)
        {
            CitizenTaxData citizenTaxData = null;
            Tax taxInfo = null;
            if (File.Exists(Server.MapPath(taxDataInput)))
            {
                taxInfo = InOutUtils.ReadTaxData(Server.MapPath(taxDataInput));
                InOutUtils.WriteTaxData(Server.MapPath(outputDataPath), taxInfo, "Initial
Tax Company Data:");
                FillTaxDataTable(taxInfo, InitTaxTable);
            }
            else
            {
                InitTaxLabel.Text = "";
            }

            if (File.Exists(Server.MapPath(citizenDataInput)))
            {
                citizenTaxData =
InOutUtils.ReadCitizenTaxData(Server.MapPath(citizenDataInput));
                InOutUtils.WriteCitizenTaxData(Server.MapPath(outputDataPath),
citizenTaxData, "Initial Citizen Tax Data:");
                FillCitizenTaxDataTable(citizenTaxData, InitCitizenTable);
            }
            else
            {
                InitCitizenLabel.Text = "";
            }

            if (citizenTaxData != null && taxInfo != null)
            {
                // Reads Initial Data and Outputs the Initial Data To WebForm and to text
                InOutUtils.CreateFile(Server.MapPath(outputDataPath));


                CitizenCalculations(taxInfo, citizenTaxData);
                CheckFiltered(taxInfo, citizenTaxData);
            }
            else
```

```
            {
                HeaderLabel.Text = "Plaese Upload remaining data files";
                CalculationsPanel.Visible = false;
            }
        }

        protected void CitizenCalculations(Tax taxInfo, CitizenTaxData citizenTaxData)
        {
            Citizen citizensAverage = citizenTaxData.CreateCitizenData(taxInfo); // For
Above Average
            InOutUtils.WriteCitizenData(Server.MapPath(outputDataPath), citizensAverage,
"Tax Sum of all citizens:");

            citizensAverage.Sort();
            InOutUtils.WriteCitizenData(Server.MapPath(outputDataPath), citizensAverage,
"Tax Sum of all citizens SORTED A-Z:");
            FillCitizenTable(citizensAverage, CitizenTaxTable);

            double sum = citizensAverage.Sum();
            double average = citizensAverage.GetAverage();
            InOutUtils.WriteHeader(Server.MapPath(outputDataPath), $"All Citizen TOTAL
Tax Sum: {sum:f}");
            InOutUtils.WriteHeader(Server.MapPath(outputDataPath), $"Average Tax Sum:
{average:f}");
            AverageTax.Text = $"Average tax per citizen: {average}";
            TotalTaxSum.Text = $"Total tax sum: {sum}";

            citizensAverage.RemoveUnderAverage();
            InOutUtils.WriteCitizenData(Server.MapPath(outputDataPath), citizensAverage,
"Citizens who paid above average:");
            FillCitizenTable(citizensAverage, AboveAverageTable);
        }
        protected void CheckFiltered(Tax taxInfo, CitizenTaxData citizenTaxData)
        {
            if (Session["TaxCode"] != null && Session["Month"] != null)
            {
                Citizen citizensFiltered = citizenTaxData.CreateCitizenData(taxInfo); //
For Filter
                citizensFiltered.Sort();
                citizensFiltered.RemoveWhoDidNotPayTax(Session["TaxCode"].ToString(),
Session["Month"].ToString(), citizenTaxData);
                InOutUtils.WriteCitizenData(Server.MapPath(outputDataPath),
citizensFiltered, $" Citizens who paid TaxCode: \"{Session["TaxCode"]}\" on Month:
\"{Session["Month"]}\"");
                FillCitizenTable(citizensFiltered, FilterTable);
            }
            else
            {
                FilterData.Text = "No Filter provided";
            }

            Session["TaxCode"] = null;
            Session["Month"] = null;
        }

        protected void FillCitizenTaxDataTable(CitizenTaxData data, Table table)
        {
            TableRow headerRow = new TableRow();
            headerRow.Cells.Add(TaskUtils.CreateCell("Last Name"));
            headerRow.Cells.Add(TaskUtils.CreateCell("First Name"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Address"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Month"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Tax Code"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Amount"));
            table.Rows.Add(headerRow);
            for (int i = 0; i < data.Count; i++)
            {
```

```
                table.Rows.Add(data.GetRow(i));
            }
        }

        protected void FillTaxDataTable(Tax data, Table table)
        {
            TableRow headerRow = new TableRow();
            headerRow.Cells.Add(TaskUtils.CreateCell("Tax Code"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Tax Company Name:"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Price:"));;
            table.Rows.Add(headerRow);
            for (int i = 0; i < data.Count; i++)
            {
                table.Rows.Add(data.GetRow(i));
            }
        }

        protected void FillCitizenTable(Citizen data, Table table)
        {
            TableRow headerRow = new TableRow();
            headerRow.Cells.Add(TaskUtils.CreateCell("Last Name"));
            headerRow.Cells.Add(TaskUtils.CreateCell("First Name"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Address"));
            headerRow.Cells.Add(TaskUtils.CreateCell("Tax Sum"));
            table.Rows.Add(headerRow);
            for (int i = 0; i < data.Count; i++)
            {
                table.Rows.Add(data.GetRow(i));
            }
        }

        protected void ButtonFilter_Click(object sender, EventArgs e)
        {
            string taxCode = TaxCodeTextBox.Text;
            string month = TaxMonthTextBox.Text;
            if (month != "" && taxCode != null)
            {
                Session["TaxCode"] = TaxCodeTextBox.Text;
                Session["Month"] = TaxMonthTextBox.Text;
            }
            Response.Redirect("Lab01Form.aspx");
        }

        protected void DataButton_Click(object sender, EventArgs e)
        {
            if(FileUpload1.HasFile)
            {
                FileUpload1.SaveAs(Server.MapPath(taxDataInput));
            }
            if (FileUpload2.HasFile)
            {
                FileUpload2.SaveAs(Server.MapPath(citizenDataInput));
            }
            Response.Redirect("Lab01Form.aspx");
        }
    }
}
```

2.7. Pradiniai duomenys ir rezultatai

Pradiniai duomenys 1

U16a.txt:

```
11; Elektra; 0.12
21; Dujos; 0.58
31; Benzinas; 1.78
32; Diezelis; 1.90
```

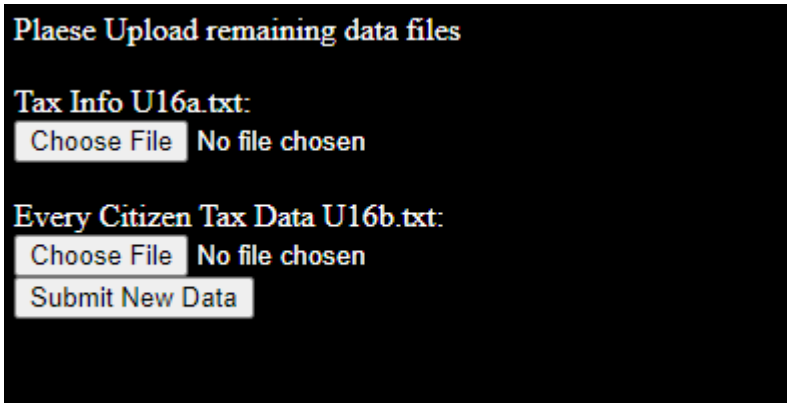
U16b.txt:

```
pavardė1; vardas1; adresas1;1;22;28;
pavardė1; vardas1; adresas1;5;22;20;
pavardė1; vardas1; adresas1;1;32;100;
pavardė1; vardas1; adresas1;2;32;97;
pavardė1; vardas1; adresas1;3;32;63;
pavardė1; vardas1; adresas1;2;22;25;
pavardė1; vardas1; adresas1;3;22;29;
pavardėAA; vardasAA; adresasAA;1;21;13;
pavardėAA; vardasAA; adresasAA;2;21;84;
pavardėAA; vardasAA; adresasAA;3;21;76;
pavardė1; vardas1; adresas1;4;22;39;
pavardė2; vardas2; adresas2;3;31;67;
pavardė2; vardas2; adresas2;4;31;98;
pavardė0; vardas2; adresas2;5;31;125;
pavardė0; vardas0; adresas3;1;11;31;
pavardė1; vardas1; adresas1;4;32;39;
pavardė1; vardas1; adresas1;5;32;20;
pavardė1; vardas1; adresas1;3;11;80;
pavardė1; vardas1; adresas1;4;11;39;
pavardė1; vardas1; adresas1;1;11;120;
pavardė1; vardas1; adresas1;2;11;100;
pavardė1; vardas1; adresas1;5;11;139;
pavardė2; vardas2; adresas2;1;31;31;
pavardė2; vardas2; adresas2;2;31;48;
pavardė0; vardas0; adresas3;2;11;48;
pavardė0; vardas0; adresas3;3;11;67;
pavardė0; vardas0; adresas3;4;11;98;
pavardė0; vardas0; adresas3;5;11;125;
pavardėAA; vardasAA; adresasAA;4;21;8;
pavardėAA; vardasAA; adresasAA;5;21;25;
```

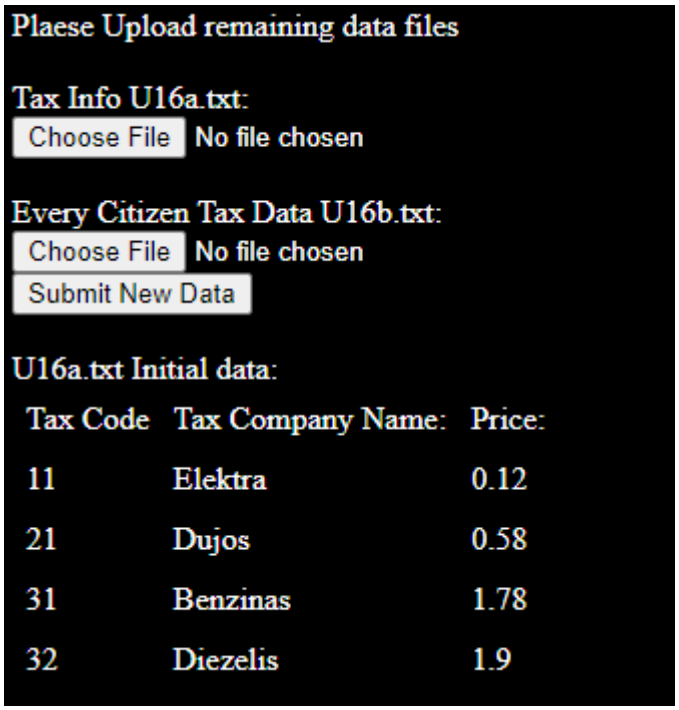
Rezultatai 1:

Vartotojo sąsaja:

Duombazėje nerado jokio failo:



Prikabinamo U16a.txt failą:



Prikabinome U16b.txt:

LAB02 U16

Tax Info U16a.txt:
Choose File No file chosen

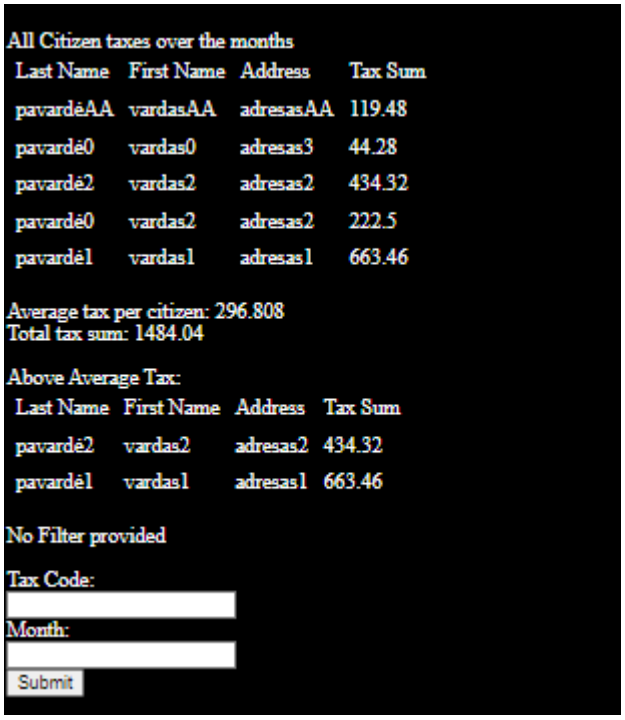
Every Citizen Tax Data U16b.txt:
Choose File No file chosen
Submit New Data

U16a.txt Initial data:

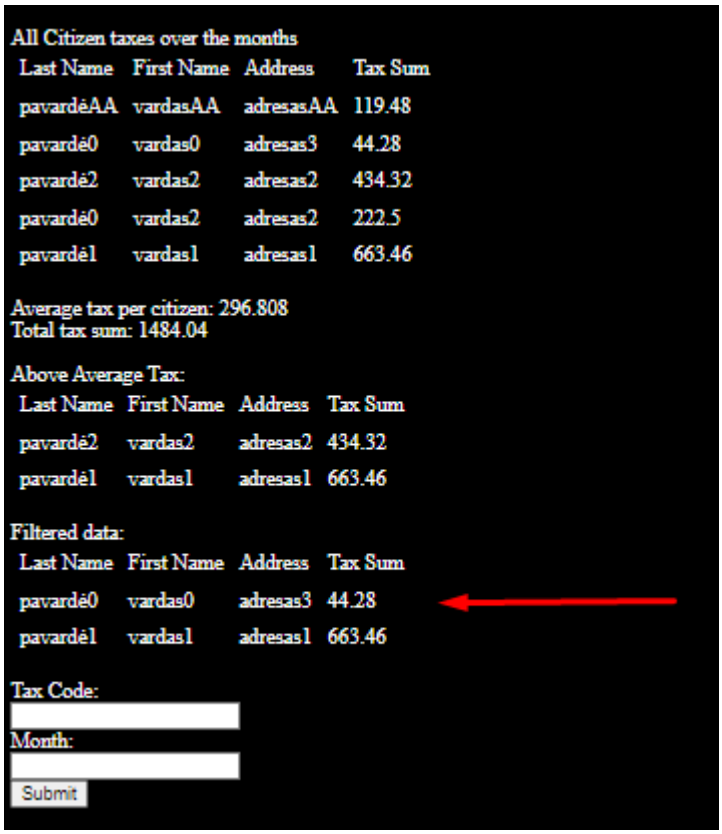
Tax Code	Tax Company Name:	Price:
11	Elektra	0.12
21	Dujos	0.58
31	Benzinas	1.78
32	Diezelis	1.9

U16b.txt Initial data:

Last Name	First Name	Address	Month	Tax Code	Amount
pavardė1	vardas1	adresas1	1	22	28
pavardė1	vardas1	adresas1	5	22	20
pavardė1	vardas1	adresas1	1	32	100
pavardė1	vardas1	adresas1	2	32	97
pavardė1	vardas1	adresas1	3	32	63
pavardė1	vardas1	adresas1	2	22	25
pavardė1	vardas1	adresas1	3	22	29
pavardėAA	vardasAA	adresasAA	1	21	13
pavardėAA	vardasAA	adresasAA	2	21	84
pavardėAA	vardasAA	adresasAA	3	21	76
pavardė1	vardas1	adresas1	4	22	39
pavardė2	vardas2	adresas2	3	31	67
pavardė2	vardas2	adresas2	4	31	98
pavardė0	vardas2	adresas2	5	31	125
pavardė0	vardas0	adresas3	1	11	31
pavardė1	vardas1	adresas1	4	32	39
pavardė1	vardas1	adresas1	5	32	20
pavardė1	vardas1	adresas1	3	11	80
pavardė1	vardas1	adresas1	4	11	39
pavardė1	vardas1	adresas1	1	11	120
pavardė1	vardas1	adresas1	2	11	100
pavardė1	vardas1	adresas1	5	11	139
pavardė2	vardas2	adresas2	1	31	31
pavardė2	vardas2	adresas2	2	31	48
pavardė0	vardas0	adresas3	2	11	48
pavardė0	vardas0	adresas3	3	11	67
pavardė0	vardas0	adresas3	4	11	98
pavardė0	vardas0	adresas3	5	11	125
pavardėAA	vardasAA	adresasAA	4	21	8
pavardėAA	vardasAA	adresasAA	5	21	25



Prafiltravome duomenis pagal kodą: „11“, mėnesį: „2“. Prisidėjo lentelė papildoma.



U16result.txt:

Tax Sum of all citizens:

LastName	FirstName	Address	TaxSum
pavardė1	vardas1	adresas1	663.46
pavardėAA	vardasAA	adresasAA	119.48
pavardė2	vardas2	adresas2	434.32
pavardė0	vardas2	adresas2	222.50
pavardė0	vardas0	adresas3	44.28

Tax Sum of all citizens SORTED A-Z:

LastName	FirstName	Address	TaxSum
pavardėAA	vardasAA	adresasAA	119.48
pavardė0	vardas0	adresas3	44.28
pavardė2	vardas2	adresas2	434.32
pavardė0	vardas2	adresas2	222.50
pavardė1	vardas1	adresas1	663.46

All Citizen TOTAL Tax Sum: 1484.04

Average Tax Sum: 296.81

Citizens who paid above average:

LastName	FirstName	Address	TaxSum
pavardė2	vardas2	adresas2	434.32
pavardė1	vardas1	adresas1	663.46

Citizens who paid TaxCode: "11" on Month: "2"

LastName	FirstName	Address	TaxSum
pavardė0	vardas0	adresas3	44.28
pavardė1	vardas1	adresas1	663.46

Duomenys 2:

U16a.txt:

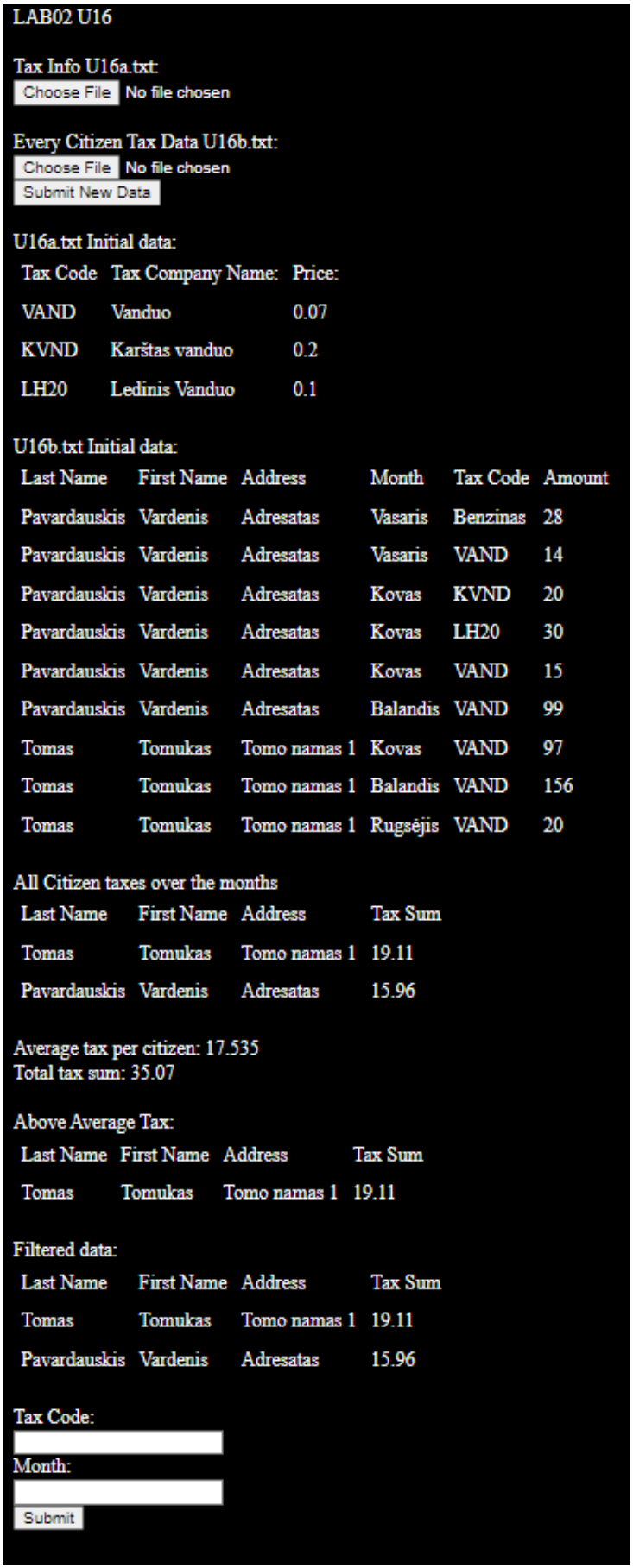
```
VAND; Vanduo; 0.07
KVND; Karštas vanduo; 0.20
LH20; Ledinis Vanduo; 0.10
```

U16b.txt:

```
Pavardauskis; Vardenis; Adresatas;Vasaris;Benzinas;28;
Pavardauskis; Vardenis; Adresatas;Vasaris;VAND;14;
Pavardauskis; Vardenis; Adresatas;Kovas;KVND;20;
Pavardauskis; Vardenis; Adresatas;Kovas;LH20;30;
Pavardauskis; Vardenis; Adresatas;Kovas;VAND;15;
Pavardauskis; Vardenis; Adresatas;Balandis;VAND;99;
Tomas; Tomukas; Tomo namas 1;Kovas;VAND;97;
Tomas; Tomukas; Tomo namas 1;Balandis;VAND;156;
Tomas; Tomukas; Tomo namas 1;Rugsėjis;VAND;20;
```

Rezultatai:

Vartotojo sąsaja
Naudojant mėnesį: Balandis ir mokesčių kodą: VAND:



LAB02 U16

Tax Info U16a.txt:
Choose File No file chosen

Every Citizen Tax Data U16b.txt:
Choose File No file chosen
Submit New Data

U16a.txt Initial data:

Tax Code	Tax Company Name:	Price:
VAND	Vanduo	0.07
KVND	Karštas vanduo	0.2
LH20	Ledinis Vanduo	0.1

U16b.txt Initial data:

Last Name	First Name	Address	Month	Tax Code	Amount
Pavardauskis	Vardenis	Adresatas	Vasaris	Benzinas	28
Pavardauskis	Vardenis	Adresatas	Vasaris	VAND	14
Pavardauskis	Vardenis	Adresatas	Kovas	KVND	20
Pavardauskis	Vardenis	Adresatas	Kovas	LH20	30
Pavardauskis	Vardenis	Adresatas	Kovas	VAND	15
Pavardauskis	Vardenis	Adresatas	Balandis	VAND	99
Tomas	Tomukas	Tomo namas 1	Kovas	VAND	97
Tomas	Tomukas	Tomo namas 1	Balandis	VAND	156
Tomas	Tomukas	Tomo namas 1	Rugsėjis	VAND	20

All Citizen taxes over the months

Last Name	First Name	Address	Tax Sum
Tomas	Tomukas	Tomo namas 1	19.11
Pavardauskis	Vardenis	Adresatas	15.96

Average tax per citizen: 17.535
Total tax sum: 35.07

Above Average Tax:

Last Name	First Name	Address	Tax Sum
Tomas	Tomukas	Tomo namas 1	19.11

Filtered data:

Last Name	First Name	Address	Tax Sum
Tomas	Tomukas	Tomo namas 1	19.11
Pavardauskis	Vardenis	Adresatas	15.96

Tax Code:
Month:
Submit

```
U16result.txt:

Tax Sum of all citizens:

LastName             FirstName           |Address             |TaxSum    |
Pavardauskis          Vardenis           | Adresatas          |     15.96|
Tomas                 Tomukas            | Tomo namas 1       |     19.11|

Tax Sum of all citizens SORTED A-Z:

LastName             FirstName           |Address             |TaxSum    |
Tomas                 Tomukas            | Tomo namas 1       |     19.11|
Pavardauskis          Vardenis           | Adresatas          |     15.96|

All Citizen TOTAL Tax Sum: 35.07

Average Tax Sum: 17.54

Citizens who paid above average:

LastName             FirstName           |Address             |TaxSum    |
Tomas                 Tomukas            | Tomo namas 1       |     19.11|

Citizens who paid TaxCode: "VAND" on Month: "Balandis"

LastName             FirstName           |Address             |TaxSum    |
Tomas                 Tomukas            | Tomo namas 1       |     19.11|
Pavardauskis          Vardenis           | Adresatas          |     15.96|
```

2.8. Dėstytojo pastabos

3. Bendrinės klasės ir testavimas (L3)

3.1. Darbo užduotis

3.2. Grafinės vartotojo sąsajos schema

3.3. Sąsajoje panaudotų komponentų keičiamos savybės

Komponentas	Savybė	Reikšmė

3.4. Klasių diagrama

3.5. Programos vartotojo vadovas

3.6. Programos tekstas

3.7. Pradiniai duomenys ir rezultatai

3.8. Dėstytojo pastabos

4. Polimorfizmas ir išimčių valdymas (L4)

4.1. Darbo užduotis

4.2. Grafinės vartotojo sąsajos schema

4.3. Sąsajoje panaudotų komponentų keičiamos savybės

Komponentas	Savybė	Reikšmė

4.4. Klasių diagrama

4.5. Programos vartotojo vadovas

4.6. Programos tekstas

4.7. Pradiniai duomenys ir rezultatai

4.8. Dėstytojo pastabos

5. Deklaratyvusis programavimas (L5)

5.1. Darbo užduotis

5.2. Grafinės vartotojo sąsajos schema

5.3. Sąsajoje panaudotų komponentų keičiamos savybės

Komponentas	Savybė	Reikšmė

5.4. Klasių diagrama

5.5. Programos vartotojo vadovas

5.6. Programos tekstas

5.7. Pradiniai duomenys ir rezultatai

5.8. Dėstytojo pastabos