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Факультет інформатики та обчислювальної техніки

Кафедра інформатики та програмної інженерії

Звіт

з лабораторної роботи №3
з дисципліни
«Основи розробки програмного забезпечення на платформі Microsoft.NET»

«JSON»

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Київ 2024

Комп‘ютерний практикум № 3

JSON

Мета: ознайомитися з обробкою даних у форматі JSON в C#.

Опис архітектури проекту

Програма має такі класи: Commandant, Hostel, Settlement і Student.

Commandant – клас, що являє собою сутність «комендант». Містить таку інформацію: індефікаційний номер, ім’я, вік, досвід та гендер. Об’єкти даного класу можна вивести за допомогою перевантаженого методу ToString().

Student – клас, що являє собою сутність «студент». Містить таку інформацію: індефікаційний номер, ім’я, факультет, кафедра, курс,рік народження та гендер. Об’єкти даного класу можна вивести за допомогою перевантаженого методу ToString().

Hostel – клас, що являє собою сутність «гуртожиток». Містить таку інформацію: індефікаційний номер, адреса, кількість кімнат та індефікаційний номер коменданта. Об’єкти даного класу можна вивести за допомогою перевантаженого методу ToString().

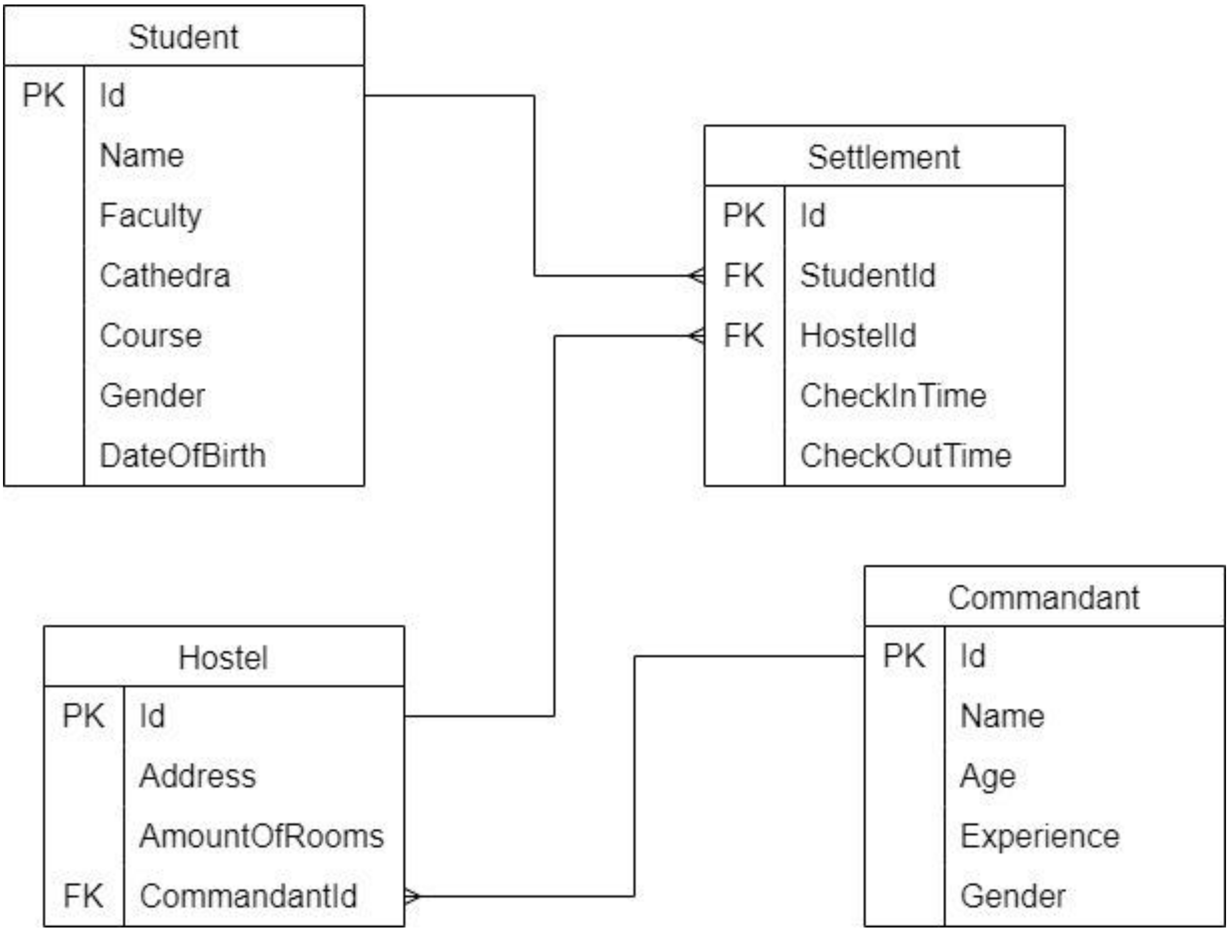
Settlement – проміжний клас, що являє собою сутність «заселення». Слугує для вирішення зв’язку many-to-many між класами Student та Hostel. Містить таку інформацію: індефікаційний номер, індефікаційний номер студента, індефікаційний номер гуртожитку, час заселення та час виселення. Об’єкти даного класу можна вивести за допомогою перевантаженого методу ToString().

Зв’язки між класами:

Student та Hostel – many-to-many, вирішений за допомогою класу Settlement. Багато студентів можуть жити в багатьох гуртожитках

Hostel та Commandant – one-to-many. Вахтер може працювати в будь-якому з гуртожитків, але в одному.

ER-модель



Текст програми

Commandant.cs

```
public class Commandant
{
    public int Id;
    public string Name;
    public int Age;
    public int Experience;
    public string Gender;

    public override string ToString()
    {
        return $"Id: {Id}, Name: {Name}, Age: {Age}, Experience: {Experience}
years";
```

```
    }
}
```

Hostel.cs

```
public class Hostel
{
    public int Id;
    public string Address;
    public int AmountOfRooms;
    public int CommandantId;

    public override string ToString()
    {
        return $"Id: {Id}, Address: {Address}, Amount of Rooms: {AmountOfRooms},
Commandant Id: {CommandantId}";
    }
}
```

Student.cs

```
public class Student
{
    public int Id;
    public string Name;
    public string Faculty;
    public string Cathedra;
    public int Course;
    public string Gender;
    public int YearOfBirth;

    public override string ToString()
    {
        return $"Id: {Id}, Name: {Name}, Faculty: {Faculty}, Cathedra: {Cathedra},
Course: {Course}";
    }
}
```

Settlement.cs

```
public class Settlement
{
    public int Id;
    public int StudentId;
    public int HostelId;

    public DateTime CheckInTime;
    public DateTime CheckOutTime;

    public override string ToString()
    {
        return $"Id: {Id}, StudentId: {StudentId}, HostelId: {HostelId},
CheckInTime: {CheckInTime}, CheckOutTime: {CheckOutTime}";
    }
}
```

Program.cs

```
namespace net_lab3

{

    internal class Program
    {
        static void Main(string[] args)
        {
            //creating data
            List<Student> students = new List<Student>
                    {
                        new Student { Id = 1, Name = "Joe", Faculty = "FICT", Cathedra =
"IPI", Course = 1, Gender = "Male", YearOfBirth = 2006 },
                        new Student { Id = 2, Name = "Nadiya", Faculty = "FICT",
Cathedra = "IPI", Course = 1, Gender = "Female", YearOfBirth = 2006 },
                        new Student { Id = 3, Name = "Alexandr", Faculty = "FICT",
Cathedra = "IPI", Course = 2, Gender = "Male", YearOfBirth = 2005 },
                        new Student { Id = 4, Name = "Myhailo", Faculty = "FICT",
Cathedra = "IPI", Course = 2, Gender = "Male", YearOfBirth = 2004 },
                        new Student { Id = 5, Name = "Oksana", Faculty = "FICT",
Cathedra = "OT", Course = 3, Gender = "Female", YearOfBirth = 2002 }
                    };

            List<Commandant> commandants = new List<Commandant>
                    {
                        new Commandant { Id = 1, Name = "Adriy", Age = 40, Experience
= 5, Gender = "Male" },
                        new Commandant { Id = 2, Name = "Olena", Age = 45, Experience
= 1, Gender = "Female" },
                        new Commandant { Id = 3, Name = "Sophia", Age = 60,
Experience = 23, Gender = "Female" },
                        new Commandant { Id = 4, Name = "Oksana", Age = 70,
Experience = 4, Gender = "Female" },
                        new Commandant { Id = 5, Name = "Maxik", Age = 43,
Experience = 14, Gender = "Male" }
```

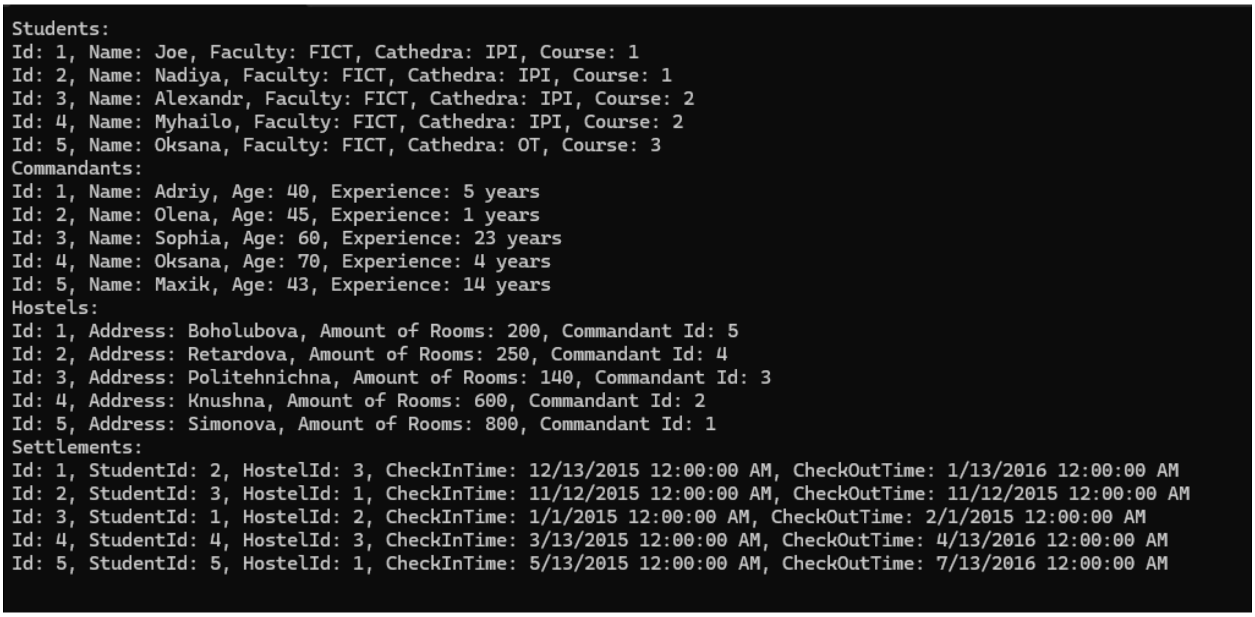
```
            };

        List<Hostel> hostels = new List<Hostel>
            {
              new Hostel { Id = 1, Address = "Boholubova", AmountOfRooms = 200, CommandantId = 5 },
              new Hostel { Id = 2, Address = "Retardova", AmountOfRooms = 250, CommandantId = 4 },
              new Hostel { Id = 3, Address = "Politehnichna", AmountOfRooms = 140, CommandantId = 3 },
              new Hostel { Id = 4, Address = "Knushna", AmountOfRooms = 600, CommandantId = 2 },
              new Hostel { Id = 5, Address = "Simonova", AmountOfRooms = 800, CommandantId = 1 }
            };

        List<Settlement> settlements = new List<Settlement>
            {
              new Settlement { Id = 1, StudentId = 2, HostelId = 3, CheckInTime = new DateTime(2015, 12, 13), CheckOutTime = new DateTime(2016, 1, 13) },
              new Settlement { Id = 2, StudentId = 3, HostelId = 1, CheckInTime = new DateTime(2015, 11, 12), CheckOutTime = new DateTime(2015, 11, 12) },
              new Settlement { Id = 3, StudentId = 1, HostelId = 2, CheckInTime = new DateTime(2015, 1, 1), CheckOutTime = new DateTime(2015, 2, 1) },
              new Settlement { Id = 4, StudentId = 4, HostelId = 3, CheckInTime = new DateTime(2015, 3, 13), CheckOutTime = new DateTime(2016, 4, 13) },
              new Settlement { Id = 5, StudentId = 5, HostelId = 1, CheckInTime = new DateTime(2015, 5, 13), CheckOutTime = new DateTime(2016, 7, 13) }
        };
```

```
      //serialize data
      SerializeData(students, commandants, hostels, settlements);

      //deserialize data
      List<Student> deserializedStudents = 
DeserializeData<Student>("students.json");
      List<Hostel> deserializedHostels = 
DeserializeData<Hostel>("hostels.json");
      List<Commandant> deserializedCommandants = 
DeserializeData<Commandant>("commandants.json");
      List<Settlement> deserializedSettlements = 
DeserializeData<Settlement>("settlements.json");

      //display

DisplayData(deserializedStudents,deserializedCommandants,deserializedHostels,d
eserializedSettlements);
      Console.ReadKey();

      DispalayDataJsonDocument();
      Console.ReadKey();

      DisplayDataJsonNode();
      Console.ReadKey();
    }

    static void DispalayDataJsonDocument()
    {
      // JsonDocument
      Console.WriteLine("\nJsonDocument:\n");
      using (JsonDocument document =
JsonDocument.Parse(File.OpenRead("students.json")))
      {
        Console.WriteLine("Students:");
        foreach (JsonElement element in
document.RootElement.EnumerateArray())
        {
          int id = element.GetProperty("Id").GetInt32();
          string name = element.GetProperty("Name").GetString();
          string faculty = element.GetProperty("Faculty").GetString();
          string cathedra = element.GetProperty("Cathedra").GetString();
          int course = element.GetProperty("Course").GetInt32();
          string gender = element.GetProperty("Gender").GetString();
          int yearOfBirth = element.GetProperty("YearOfBirth").GetInt32();
          Console.WriteLine($"Id: {id}, Name: {name}, Faculty: {faculty},
Cathedra: {cathedra}," +
            $" Course: {course}, Gender: {gender}, Year of Birth:
{yearOfBirth}");
        }
      }

      using (JsonDocument document =
JsonDocument.Parse(File.OpenRead("commandants.json")))
      {
        Console.WriteLine("\nCommandants:");
        foreach (JsonElement element in
document.RootElement.EnumerateArray())
        {
          int id = element.GetProperty("Id").GetInt32();
```

```
                    string name = element.GetProperty("Name").GetString();
                    int age = element.GetProperty("Age").GetInt32();
                    int experience = element.GetProperty("Experience").GetInt32();
                    string gender = element.GetProperty("Gender").GetString();
                    Console.WriteLine($"Id: {id}, Name: {name}, Age: {age},
Experience: {experience}, Gender: {gender}");
                }
            }

            using (JsonDocument document =
JsonDocument.Parse(File.OpenRead("hostels.json")))
            {
                Console.WriteLine("\nHostels:");
                foreach (JsonElement element in
document.RootElement.EnumerateArray())
                {
                    int id = element.GetProperty("Id").GetInt32();
                    string address = element.GetProperty("Address").GetString();
                    int amountOfRooms =
element.GetProperty("AmountOfRooms").GetInt32();
                    int commandantId =
element.GetProperty("CommandantId").GetInt32();
                    Console.WriteLine($"Id: {id}, Address: {address}, AmountOfRooms:
{amountOfRooms}, CommandantId: {commandantId}");
                }
            }

            using (JsonDocument document =
JsonDocument.Parse(File.OpenRead("settlements.json")))
            {
                Console.WriteLine("\nSettlements:");
                foreach (JsonElement element in document.RootElement.EnumerateArray())
                {
                    int id = element.GetProperty("Id").GetInt32();
                    int studentId = element.GetProperty("StudentId").GetInt32();
                    int hostelId = element.GetProperty("HostelId").GetInt32();
                    DateTime checkInTime = element.GetProperty("CheckInTime").GetDateTime();
                    DateTime checkOutTime = element.GetProperty("CheckOutTime").GetDateTime();
                    Console.WriteLine($"Id: {id}, StudentId: {studentId}, HostelId: {hostelId}, CheckInTime: {checkInTime}, CheckOutTime: {checkOutTime}");

                }
            }

        }

        static void DisplayDataJsonNode()
        {
            Console.WriteLine("\nJsonNode:\n");

            // Читання та обробка файлу students.json
            string studentsJson = File.ReadAllText("students.json");
            JsonNode studentsNode = JsonNode.Parse(studentsJson);

            Console.WriteLine("Students:");

            foreach (JsonNode studentNode in studentsNode.AsArray())
            {
                Console.WriteLine($"\nId: {studentNode["Id"].GetValue<int>()}");
                Console.WriteLine($"Name:
      {studentNode["Name"].GetValue<string>()}");
                Console.WriteLine($"Faculty:
      {studentNode["Faculty"].GetValue<string>()}");
                Console.WriteLine($"Cathedra:
      {studentNode["Cathedra"].GetValue<string>()}");
                Console.WriteLine($"Course:
      {studentNode["Course"].GetValue<int>()}");
                Console.WriteLine($"Gender:
      {studentNode["Gender"].GetValue<string>()}");
                Console.WriteLine($"Year of Birth:
      {studentNode["YearOfBirth"].GetValue<int>()}");
            }

            // Читання та обробка файлу hostels.json
            string hostelsJson = File.ReadAllText("hostels.json");
            JsonNode hostelsNode = JsonNode.Parse(hostelsJson);

            Console.WriteLine("\nHostels:");

            foreach (JsonNode hostelNode in hostelsNode.AsArray())
            {
                Console.WriteLine($"\nId: {hostelNode["Id"].GetValue<int>()}");
                Console.WriteLine($"Address:
      {hostelNode["Address"].GetValue<string>()}");
                Console.WriteLine($"Amount of Rooms:
      {hostelNode["AmountOfRooms"].GetValue<int>()}");
```

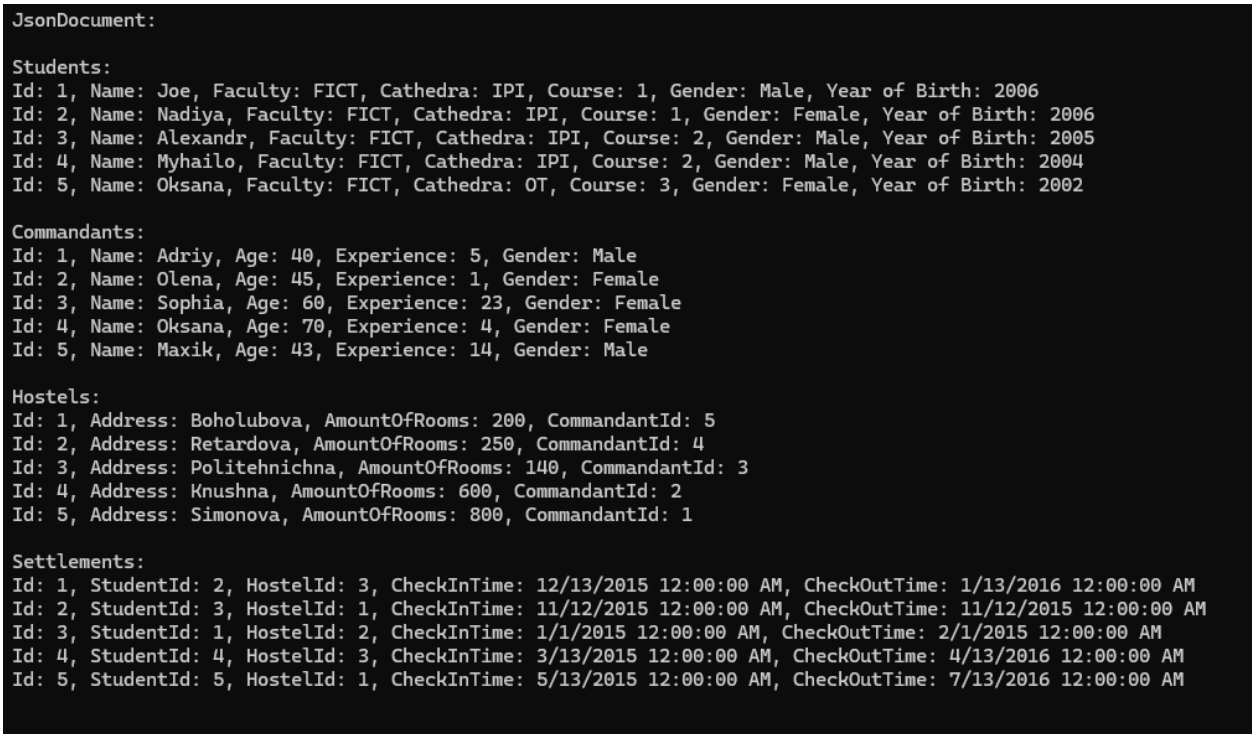
```
                Console.WriteLine($"Commandant Id:
{hostelNode["CommandantId"].GetValue<int>()}");
            }

            // Читання та обробка файлу settlements.json
            string settlementsJson = File.ReadAllText("settlements.json");
            JsonNode settlementsNode = JsonNode.Parse(settlementsJson);

            Console.WriteLine("\nSettlements:");

            foreach (JsonNode settlementNode in settlementsNode.AsArray())
            {
                Console.WriteLine($"\nId: {settlementNode["Id"].GetValue<int>()}");
                Console.WriteLine($"Student Id:
{settlementNode["StudentId"].GetValue<int>()}");
                Console.WriteLine($"Hostel Id:
{settlementNode["HostelId"].GetValue<int>()}");
                Console.WriteLine($"Check In Time:
{settlementNode["CheckInTime"].GetValue<DateTime>()}");
                Console.WriteLine($"Check Out Time:
{settlementNode["CheckOutTime"].GetValue<DateTime>()}");
            }

            // Читання та обробка файлу commandants.json
            string commandantsJson = File.ReadAllText("commandants.json");
            JsonNode commandantsNode = JsonNode.Parse(commandantsJson);

            Console.WriteLine("\nCommandants:");

            foreach (JsonNode commandantNode in commandantsNode.AsArray())
            {
                Console.WriteLine($"\nId:
{commandantNode["Id"].GetValue<int>()}");
                Console.WriteLine($"Name:
{commandantNode["Name"].GetValue<string>()}");
                Console.WriteLine($"Age:
{commandantNode["Age"].GetValue<int>()}");
                Console.WriteLine($"Experience:
{commandantNode["Experience"].GetValue<int>()}");
                Console.WriteLine($"Gender:
{commandantNode["Gender"].GetValue<string>()}");
            }

        }

        static void SerializeData(List<Student> students, List<Commandant>
commandants,
                List<Hostel> hostels, List<Settlement> settlements)
        {
            string studentsJson = JsonConvert.SerializeObject(students,
Newtonsoft.Json.Formatting.Indented);
            File.WriteAllText("students.json", studentsJson);

            string commandantsJson = JsonConvert.SerializeObject(commandants,
Newtonsoft.Json.Formatting.Indented);
            File.WriteAllText("commandants.json", commandantsJson);

            string hostelsJson = JsonConvert.SerializeObject(hostels,
Newtonsoft.Json.Formatting.Indented);
            File.WriteAllText("hostels.json", hostelsJson);
            string settlementsJson = JsonConvert.SerializeObject(settlements,
Newtonsoft.Json.Formatting.Indented);
            File.WriteAllText("settlements.json", settlementsJson);
        }

        static List<T> DeserializeData<T>(string path)
        {
            List<T> list = new List<T>();
            string textJson = File.ReadAllText(path);
            if (!string.IsNullOrWhiteSpace(textJson))
            {
                list = JsonConvert.DeserializeObject<List<T>>(textJson);
            }
            return list;
        }

        static void DisplayData(List<Student> students, List<Commandant>
commandants,
            List<Hostel> hostels, List<Settlement> settlements)
        {

            Console.WriteLine("Students: ");
            foreach (Student student in students)
            {
                Console.WriteLine(student);
            }

            Console.WriteLine("Commandants: ");
            foreach (Commandant commandant in commandants)
            {
                Console.WriteLine(commandant);
            }

            Console.WriteLine("Hostels: ");
            foreach (Hostel hostel in hostels)
            {
                Console.WriteLine(hostel);
            }

            Console.WriteLine("Settlements: ");
            foreach (Settlement settlement in settlements)
            {
                Console.WriteLine(settlement);
            }
        }
    }
}
```

Скріншоти виконання



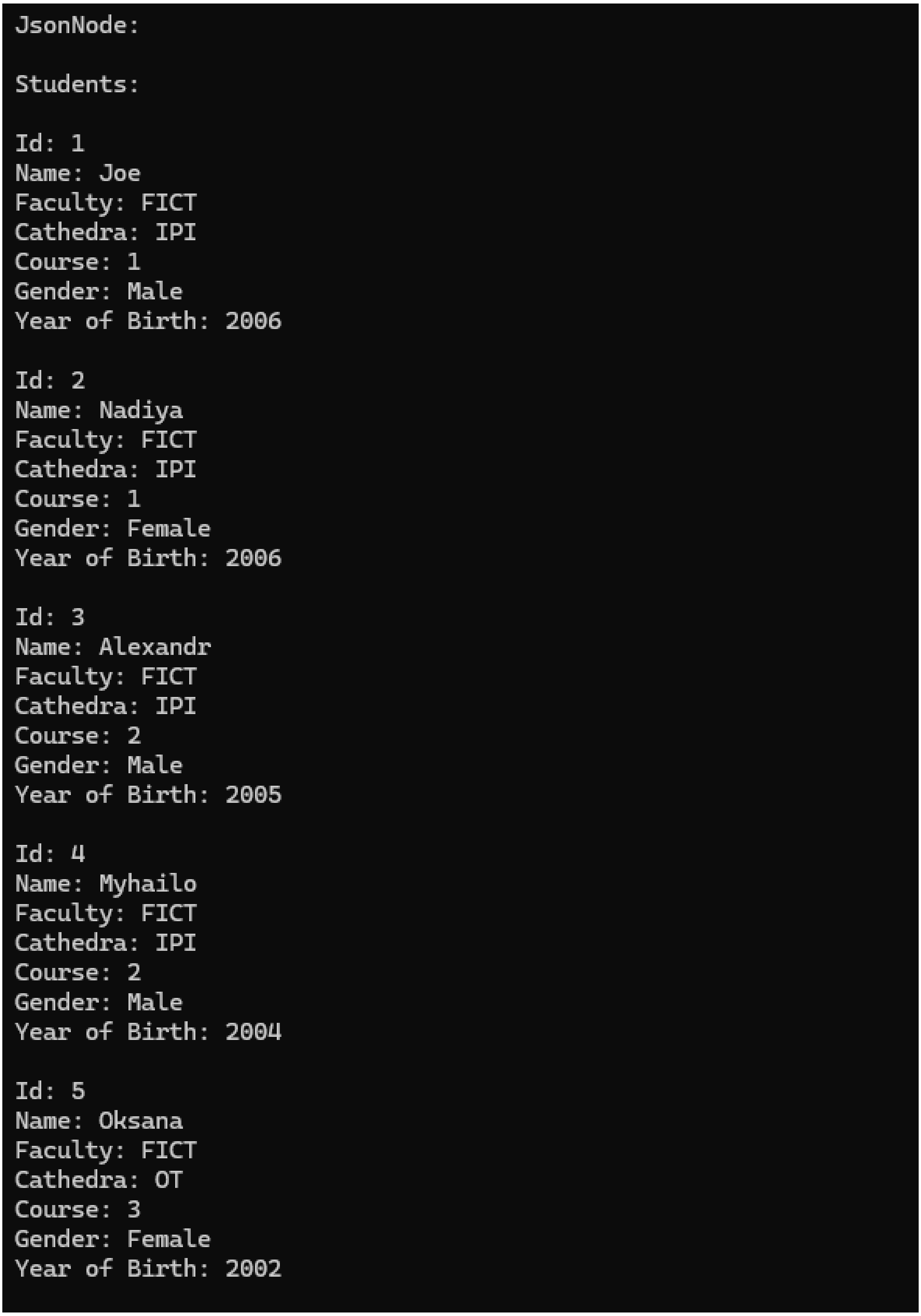
```
Students:
Id: 1, Name: Joe, Faculty: FICT, Cathedra: IPI, Course: 1
Id: 2, Name: Nadiya, Faculty: FICT, Cathedra: IPI, Course: 1
Id: 3, Name: Alexandr, Faculty: FICT, Cathedra: IPI, Course: 2
Id: 4, Name: Myhailo, Faculty: FICT, Cathedra: IPI, Course: 2
Id: 5, Name: Oksana, Faculty: FICT, Cathedra: OT, Course: 3
Commandants:
Id: 1, Name: Adriy, Age: 40, Experience: 5 years
Id: 2, Name: Olena, Age: 45, Experience: 1 years
Id: 3, Name: Sophia, Age: 60, Experience: 23 years
Id: 4, Name: Oksana, Age: 70, Experience: 4 years
Id: 5, Name: Maxik, Age: 43, Experience: 14 years
Hostels:
Id: 1, Address: Boholubova, Amount of Rooms: 200, Commandant Id: 5
Id: 2, Address: Retardova, Amount of Rooms: 250, Commandant Id: 4
Id: 3, Address: Politehnichna, Amount of Rooms: 140, Commandant Id: 3
Id: 4, Address: Knushna, Amount of Rooms: 600, Commandant Id: 2
Id: 5, Address: Simonova, Amount of Rooms: 800, Commandant Id: 1
Settlements:
Id: 1, StudentId: 2, HostelId: 3, CheckInTime: 12/13/2015 12:00:00 AM, CheckOutTime: 1/13/2016 12:00:00 AM
Id: 2, StudentId: 3, HostelId: 1, CheckInTime: 11/12/2015 12:00:00 AM, CheckOutTime: 11/12/2015 12:00:00 AM
Id: 3, StudentId: 1, HostelId: 2, CheckInTime: 1/1/2015 12:00:00 AM, CheckOutTime: 2/1/2015 12:00:00 AM
Id: 4, StudentId: 4, HostelId: 3, CheckInTime: 3/13/2015 12:00:00 AM, CheckOutTime: 4/13/2016 12:00:00 AM
Id: 5, StudentId: 5, HostelId: 1, CheckInTime: 5/13/2015 12:00:00 AM, CheckOutTime: 7/13/2016 12:00:00 AM
```

Рис. 3.1 – Використання десеріалізації

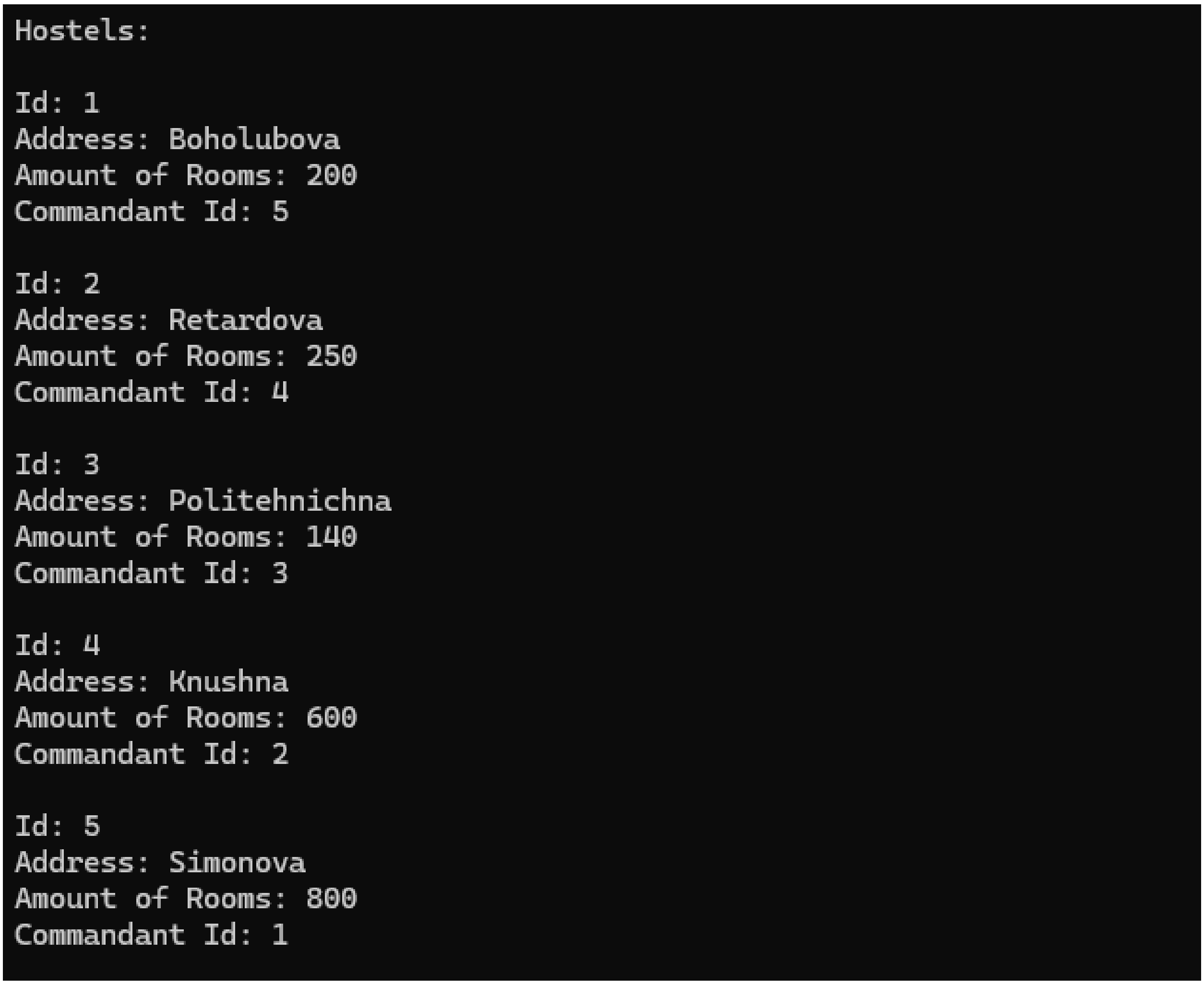


```
JsonDocument:

Students:
Id: 1, Name: Joe, Faculty: FICT, Cathedra: IPI, Course: 1, Gender: Male, Year of Birth: 2006
Id: 2, Name: Nadiya, Faculty: FICT, Cathedra: IPI, Course: 1, Gender: Female, Year of Birth: 2006
Id: 3, Name: Alexandr, Faculty: FICT, Cathedra: IPI, Course: 2, Gender: Male, Year of Birth: 2005
Id: 4, Name: Myhailo, Faculty: FICT, Cathedra: IPI, Course: 2, Gender: Male, Year of Birth: 2004
Id: 5, Name: Oksana, Faculty: FICT, Cathedra: OT, Course: 3, Gender: Female, Year of Birth: 2002

Commandants:
Id: 1, Name: Adriy, Age: 40, Experience: 5, Gender: Male
Id: 2, Name: Olena, Age: 45, Experience: 1, Gender: Female
Id: 3, Name: Sophia, Age: 60, Experience: 23, Gender: Female
Id: 4, Name: Oksana, Age: 70, Experience: 4, Gender: Female
Id: 5, Name: Maxik, Age: 43, Experience: 14, Gender: Male

Hostels:
Id: 1, Address: Boholubova, AmountOfRooms: 200, CommandantId: 5
Id: 2, Address: Retardova, AmountOfRooms: 250, CommandantId: 4
Id: 3, Address: Politehnichna, AmountOfRooms: 140, CommandantId: 3
Id: 4, Address: Knushna, AmountOfRooms: 600, CommandantId: 2
Id: 5, Address: Simonova, AmountOfRooms: 800, CommandantId: 1

Settlements:
Id: 1, StudentId: 2, HostelId: 3, CheckInTime: 12/13/2015 12:00:00 AM, CheckOutTime: 1/13/2016 12:00:00 AM
Id: 2, StudentId: 3, HostelId: 1, CheckInTime: 11/12/2015 12:00:00 AM, CheckOutTime: 11/12/2015 12:00:00 AM
Id: 3, StudentId: 1, HostelId: 2, CheckInTime: 1/1/2015 12:00:00 AM, CheckOutTime: 2/1/2015 12:00:00 AM
Id: 4, StudentId: 4, HostelId: 3, CheckInTime: 3/13/2015 12:00:00 AM, CheckOutTime: 4/13/2016 12:00:00 AM
Id: 5, StudentId: 5, HostelId: 1, CheckInTime: 5/13/2015 12:00:00 AM, CheckOutTime: 7/13/2016 12:00:00 AM
```

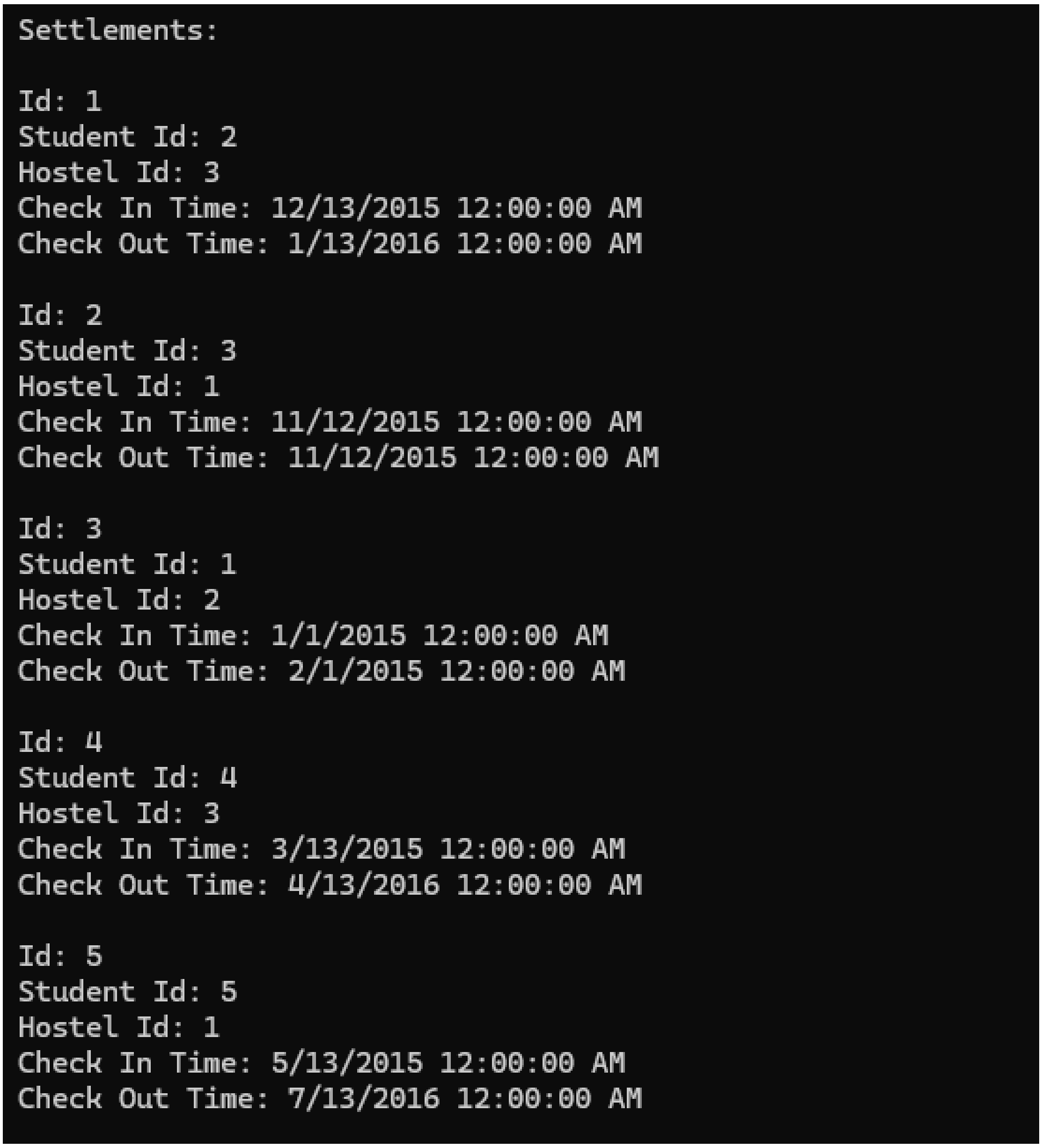
Рис. 3.2 – Використання JsonDocument



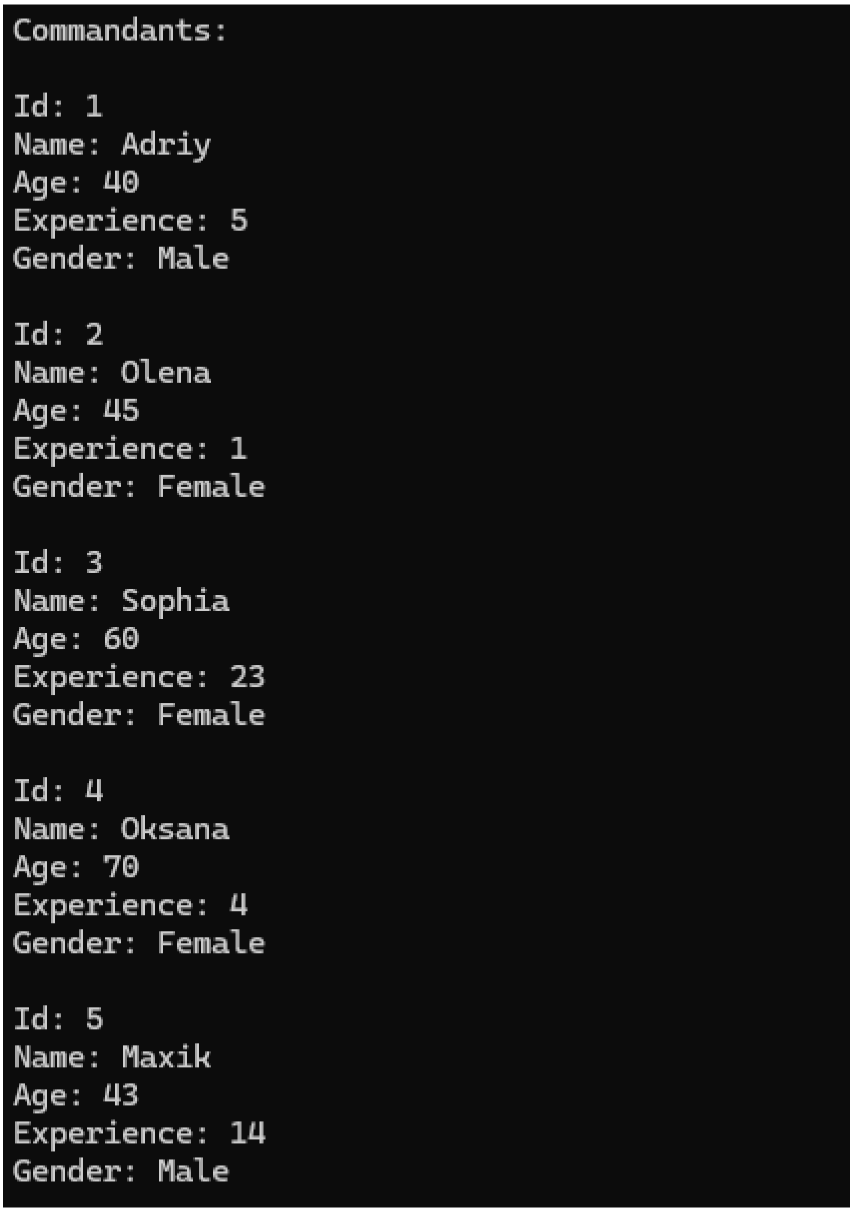
```
JsonNode:

Students:

Id: 1
Name: Joe
Faculty: FICT
Cathedra: IPI
Course: 1
Gender: Male
Year of Birth: 2006

Id: 2
Name: Nadiya
Faculty: FICT
Cathedra: IPI
Course: 1
Gender: Female
Year of Birth: 2006

Id: 3
Name: Alexandr
Faculty: FICT
Cathedra: IPI
Course: 2
Gender: Male
Year of Birth: 2005

Id: 4
Name: Myhailo
Faculty: FICT
Cathedra: IPI
Course: 2
Gender: Male
Year of Birth: 2004

Id: 5
Name: Oksana
Faculty: FICT
Cathedra: OT
Course: 3
Gender: Female
Year of Birth: 2002
```



```
Hostels:

Id: 1
Address: Boholubova
Amount of Rooms: 200
Commandant Id: 5

Id: 2
Address: Retardova
Amount of Rooms: 250
Commandant Id: 4

Id: 3
Address: Politehnichna
Amount of Rooms: 140
Commandant Id: 3

Id: 4
Address: Knushna
Amount of Rooms: 600
Commandant Id: 2

Id: 5
Address: Simonova
Amount of Rooms: 800
Commandant Id: 1
```



```
Settlements:

Id: 1
Student Id: 2
Hostel Id: 3
Check In Time: 12/13/2015 12:00:00 AM
Check Out Time: 1/13/2016 12:00:00 AM

Id: 2
Student Id: 3
Hostel Id: 1
Check In Time: 11/12/2015 12:00:00 AM
Check Out Time: 11/12/2015 12:00:00 AM

Id: 3
Student Id: 1
Hostel Id: 2
Check In Time: 1/1/2015 12:00:00 AM
Check Out Time: 2/1/2015 12:00:00 AM

Id: 4
Student Id: 4
Hostel Id: 3
Check In Time: 3/13/2015 12:00:00 AM
Check Out Time: 4/13/2016 12:00:00 AM

Id: 5
Student Id: 5
Hostel Id: 1
Check In Time: 5/13/2015 12:00:00 AM
Check Out Time: 7/13/2016 12:00:00 AM
```



```
Commandants:

Id: 1
Name: Adriy
Age: 40
Experience: 5
Gender: Male

Id: 2
Name: Olena
Age: 45
Experience: 1
Gender: Female

Id: 3
Name: Sophia
Age: 60
Experience: 23
Gender: Female

Id: 4
Name: Oksana
Age: 70
Experience: 4
Gender: Female

Id: 5
Name: Maxik
Age: 43
Experience: 14
Gender: Male
```

Рис. 3.3 – 3.6 – Використання JsonNode