НП ”Обучение за ИТ умения и кариера”

Модул 7: Разработка на софтуер

КУРСОВ ПРОЕКТ

на тема:

Библиотека

Изготвили:
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I. Цели

Разработване на мулти-интерфейсно приложение, което управлява база данни, съдържаща информацията за книги, техните автори, членовете на библиотеката и историята на заемани книги.

II. Разпределение на ролите

Михаил Тенев - работя сам затова всичкото планиране и програмен код са изработени от мен. Отговарям за: структура на проекта, планиране на таблици и връзки в базата данни, разработка на Business логика, разработка на Data структура (Models и DbContext), разработка на конзолен интерфейс и неговия Display слой, както и допълнителния помощен клас UIHelper, ASP.NET контролери и views razor станици и тестове за бизнес логиката.

III. Основни етапи в реализирането на проекта

1. Планиране на структура

Планиране на структурата на базата данни и разпределението на структурата на проекта. Избор на помощни библиотеки за разработка и избиране на GitHub за контролер на версиите.

2. Разработка на Data слоя

Добавих Entity Framework Core и допълнителни библиотеки нужни за разработката към проекта Data. Създадох DbContext в класът LibraryDbContext и модели на таблиците в Data/Models. Създадох Enums папка и добавих клас Genre, описващ enum genre - съдържащ информация за жанровете на книгите. Описах connection string и добавих опция за инжектиране на connection string от ASP.NET. Описах връзките на моделите за по-точно създаване на базата данни. Добавяме миграции и обновяваме базата данни чрез PM конзолата.

3. Разработка на Business слоя

Добавих нужните библиотеки и референция към проекта Data. За всеки модел създадох business клас, в който се описват CRUD операциите към моделите. И добавих Dispose метод от IDisposable интерфейса за премахване на контекста.

4. Разработка на конзолно приложение

Добавих референции към Business и Data слоя, както и нужните библиотеки за всички приложения. Разработих Presentation слой, който ще управлява интерфейса на конзолното приложение. Той се състои от един главен клас Display, класове Sub-displays и един помощен клас UIHelper. При разработката на слоя установих, че ще е много обемен ако цялата логика е само в Display класа, затова го разделихме на Sub-displays, като всяка таблица има свой sub-display. При разработката също създадох помощния клас UIHelper, който има за цел да помага с входа на данни и да намали обема на кода, като в него се съдържат валидациите за входните данни при въвеждане в интерфейса на конзолата. Display класът събира логиката на sub-display класовете, в тях се съдържат менюта и методите които извършват, те използват методите от Business слоя.

5. Разработка на Тестове за Business логиката

Създадох тестове за да съм сигурен дали валидно се изпълняват методите в Business логиката на всяка таблица. При разработката пробвах да използвам Moq библиотеката, но тя не подържа async методи затова смених на In Memory Database библиотеката към EF, която не само направи процеса по-лесен, а и намали обема код и ускори времето за изпълнение на тестовете.

6. Разработка на ASP.NET (MVC) уеб приложение

При създаването на ASP.NET уеб приложението реших сам да напиша controller и view логиката на всеки клас вместо да използвам scaffolding, за да може да имам повече контрол над методите на контролерите и дизайна на страниците. В дизайна също използвам JavaScript за някои елементи, като търсачки и филтри. Също и в ASP.NET приложението ми се съдържа и Seeding слоя, който има за цел, в тестова среда, когато базата данни е празна, да се попълни с тестови данни за по-лесно презентиране и тества на проекта.

IV. Реализация

Използвани технологии:

Език и платформи:

1. C#
2. JavaScript
3. ASP.NET Core MVC

ORM и база данни:

1. Microsoft.EntityFrameworkCore – ORM за работа с бази данни
2. Microsoft.EntityFrameworkCore.SqlServer – SQL Server провайдър
3. Microsoft.EntityFrameworkCore.Tools – инструменти за миграции и работа с базата
4. Microsoft.EntityFrameworkCore.InMemory – In-Memory база за тестване
5. Microsoft.VisualStudio.Web.CodeGeneration.EntityFrameworkCore – за scaffold и code generation

Тестване и покритие

1. Microsoft.NET.Test.Sdk – инфраструктура за тестове
2. NUnit – framework за юнит тестове
3. NUnit.Analyzers – анализи и правила за NUnit
4. NUnit3TestAdapter – интеграция на NUnit с Visual Studio
5. coverlet.collector – за измерване на покритие на тестовете (code coverage)

Инструменти и други

1. GitHub – контрол на версиите
2. Visual Studio – среда за разработка
3. Package Manager Console – използвана за миграции и обновяване
4. Fine Code Coverage - Отбелязва покритието на unit тестове

Описание на приложението:

Разработеното приложение представлява библиотечна система за управление на книги, автори, читатели и история на заеманите книги. Системата използва многослойна архитектура, състояща се от:

- Data слой – съдържа модели на таблиците и контекста на базата данни чрез Entity Framework Core;
- Business слой – реализира бизнес логиката и CRUD операциите за всеки модел;
- Конзолен интерфейс – позволява базово управление чрез конзолно меню, разделено по функционалност за всяка таблица;
- ASP.NET Core MVC интерфейс – уеб базиран потребителски интерфейс, позволяващ визуално управление и търсене на записи;
- Тестов слой – включва автоматизирани тестове за валидация на бизнес логиката с помощта на In-Memory база и NUnit.

Приложението е подходящо за малки библиотеки или учебни цели. То позволява:

- Добавяне, редакция и изтриване на книги, автори и читатели;
- Проследяване на история на заетите книги;
- Филтриране и търсене по различни критерии;
- Автоматично зареждане на тестови данни в празна база (Seeding).

Програмен код на по-важните методи:

Model пример (Book.cs):

```
using Data.Enums;
using System.ComponentModel.DataAnnotations;
using System.ComponentModel.DataAnnotations.Schema;

namespace Data.Models
{
    public class Book
    {
        [Key]
        public int Id { get; set; }
        [Required]
        [MaxLength(55)]
        public string Title { get; set; }
        [Required]
        public Genre Genre { get; set; }
        [StringLength(13, MinimumLength = 10, ErrorMessage = "ISBN must be between 10
and 13 characters.")]
        public string ISBN { get; set; }
        [Required]
        [DisplayFormat(DataFormatString = "{0:dd-MM-yyyy}", ApplyFormatInEditMode =
true)]
        public DateTime PublicationDate { get; set; }
        [Required]
        public int AuthorID { get; set; }

        [ForeignKey("AuthorID")]
        public Author? Author { get; set; }

        public ICollection<BorrowedBook>? BorrowedBooks { get; set; }
    }
}
```

LibraryDbContext.cs:

```
using Data.Models;
using Microsoft.EntityFrameworkCore;

namespace Data
{
    public class LibraryDbContext : DbContext
    {
        public virtual DbSet<Author> Authors { get; set; }
        public DbSet<Book> Books { get; set; }
        public DbSet<Member> Members { get; set; }
        public DbSet<BorrowedBook> BorrowedBooks { get; set; }

        // Constructor that accepts DbContextOptions
        public LibraryDbContext(DbContextOptions<LibraryDbContext> options) :
base(options)
        {
        }

        public LibraryDbContext()
        {
        }

        // Default constructor for configuring directly (in case not using DI)
        protected override void OnConfiguring(DbContextOptionsBuilder optionsBuilder)
        {
            // Check if options were already configured
            if (!optionsBuilder.IsConfigured)
            {

optionsBuilder.UseSqlServer(@"Server=.\SQLEXPRESS;Database=LibraryDb;Integrated
Security=True;TrustServerCertificate=True;");
            }
        }

        protected override void OnModelCreating(ModelBuilder modelBuilder)
        {
            base.OnModelCreating(modelBuilder);

            // Composite primary key for BorrowedBook
            modelBuilder.Entity<BorrowedBook>()
                .HasKey(bb => new { bb.BookID, bb.MemberID });

            // Unique constraint on ISBN
            modelBuilder.Entity<Book>()
                .HasIndex(b => b.ISBN)
                .IsUnique();

            // Explicit relationship mapping

            /// Book - Author
            modelBuilder.Entity<Book>()
                .HasOne(b => b.Author)
                .WithMany(a => a.Books)
                .HasForeignKey(b => b.AuthorID)
                .OnDelete(DeleteBehavior.Cascade);

            /// BorrowedBook - Book
            modelBuilder.Entity<BorrowedBook>()
                .HasOne(bb => bb.Book)
                .WithMany(b => b.BorrowedBooks)
                .HasForeignKey(bb => bb.BookID)
                .OnDelete(DeleteBehavior.Cascade);

            /// BorrowedBook - Member
            modelBuilder.Entity<BorrowedBook>()
                .HasOne(bb => bb.Member)
                .WithMany(m => m.BorrowedBooks)
                .HasForeignKey(bb => bb.MemberID)
                .OnDelete(DeleteBehavior.Cascade);

            // ENUMS stored as strings
            modelBuilder.Entity<Book>()
                .Property(b => b.Genre)
            .HasConversion<string>();
    }
```

Business пример (BookBusiness):

```
using Data;
using Data.Models;
using Microsoft.EntityFrameworkCore;

namespace Business
{
    public class BookBusiness : IDisposable
    {
        private readonly LibraryDbContext _context;
        private readonly bool _contextOwned;

        // Constructor for ASP.NET Core (DI provides the context)
        public BookBusiness(LibraryDbContext context)
        {
            _context = context;
            _contextOwned = false;
        }

        // Constructor for Console App (creates its own context)
        public BookBusiness()
        {
            _context = new LibraryDbContext();
            _contextOwned = true;
        }

        public async Task<List<Book>> GetAllAsync()
        {
                return await _context.Books.ToListAsync();
        }

        public async Task<List<Book>> GetAllWithIncludesAsync()
        {
                return await _context.Books
                    .Include(b => b.Author)
                    .Include(b => b.BorrowedBooks)
                    .ToListAsync();
        }

        public async Task<List<Book>> GetAllByGenreAsync(string genre)
        {
                return await _context.Books
                    .Where(b => b.Genre.ToString().ToLower() == genre.ToLower())
            .ToListAsync();
    }

    public async Task<List<Book>> GetAllByGenreWithIncludesAsync(string genre)
    {
        return await _context.Books
            .Include(b => b.Author)
            .Include(b => b.BorrowedBooks)
            .Where(b => b.Genre.ToString().ToLower() == genre.ToLower())
            .ToListAsync();
    }

    public async Task<Book> GetAsync(int id)
    {
        return await _context.Books.FindAsync(id);
    }
    public async Task<Book> GetWithIncludesAsync(int id)
    {
        return await _context.Books
            .Include(b => b.Author)
            .Include(b => b.BorrowedBooks)
            .FirstOrDefaultAsync(b => b.Id == id);
    }

    public async Task<Book> GetByISBNAsync(string ISBN)
    {
        return await _context.Books.FirstAsync(b => b.ISBN == ISBN);
    }

    public async Task<Book> GetByISBNWithIncludesAsync(string ISBN)
    {
        return await _context.Books
            .Include(b => b.Author)
            .Include(b => b.BorrowedBooks)
            .FirstOrDefaultAsync(b => b.ISBN == ISBN);
    }

    public async Task AddAsync(Book book)
    {
        await _context.Books.AddAsync(book);
        await _context.SaveChangesAsync();
    }

    public async Task UpdateAsync(Book book)
    {
        var item = await _context.Books.FindAsync(book.Id);
        if (item != null)
        {
                _context.Entry(item).CurrentValues.SetValues(book);
                await _context.SaveChangesAsync();
            }
        }

        public async Task DeleteAsync(int id)
        {
            var book = await _context.Books.FindAsync(id);
            if (book != null)
            {
                _context.Books.Remove(book);
                await _context.SaveChangesAsync();
            }
        }

        // Make sure you clean up if we created the context ourselves
        public void Dispose()
        {
            if (_contextOwned)
            {
                _context.Dispose();
            }
        }
    }
}
```

Sub-Display пример (BookDisplay.cs):

```
using Business;
using Data.Enums;
using Data.Models;

namespace ConsoleApp.Presentation.SubDisplays
{
    internal class BookDisplay
    {
        // Business layer objects to interact with data models
        private readonly AuthorBusiness authorBusiness = new AuthorBusiness();
        private readonly BookBusiness bookBusiness = new BookBusiness();
        private readonly MemberBusiness memberBusiness = new MemberBusiness();
        private readonly BorrowedBookBusiness borrowedBookBusiness = new
BorrowedBookBusiness();

        // UI helper to assist with common input/output operations
        private readonly UIHelper uiHelper = new UIHelper();
        /// <summary>
        /// Main function to manage book-related operations.
        /// Provides a menu for the user to choose actions like borrowing, browsing, adding,
updating, or deleting books.
        /// </summary>
        public async Task BookManager()
        {
            ShowBookMenu(); // Display the book management menu
            var operation = uiHelper.ReadIntInput("Please select an option:");

            // Execute the selected operation based on user's input
            switch (operation)
            {
                case 1:
                    await Borrow(); // Borrow a book
                    break;
                case 2:
                    await Browse(); // Browse available books
                    break;
                case 3:
                    await AddBook(); // Add a new book to the system
                    break;
                case 4:
                    await UpdateBook(); // Update book details
                    break;
                case 5:
                    await DeleteBook(); // Delete a book from the system
                    break;
                default:
                    Console.WriteLine("Invalid option."); // Invalid choice handling
                    break;
            }
        }

        // Menus for book management and browsing
        /// <summary>
        /// Displays the main menu for book management.
        /// </summary>
        private void ShowBookMenu()
        {
            uiHelper.ShowHeader("Book Management");
            Console.WriteLine("1. Borrow a Book");
            Console.WriteLine("2. Browse Books");
            Console.WriteLine("3. Add books");
            Console.WriteLine("4. Update books");
            Console.WriteLine("5. Delete books");
        }
```

```
/// <summary>
/// Displays the menu for browsing books by different criteria.
/// </summary>
private void ShowBrowseBooks()
{
    uiHelper.ShowHeader("Browse Books");
    Console.WriteLine("1. All Books");
    Console.WriteLine("2. By Genre");
    Console.WriteLine("3. Fetch by ID");
    Console.WriteLine("4. Fetch by ISBN");
}

// Main functions to perform actions on books
/// <summary>
/// Allows the user to borrow a book. First prompts the user to browse books.
/// </summary>
private async Task Borrow()
{
    ShowBrowseBooks(); // Show browsing options
    var operation = uiHelper.ReadIntInput("Please select an option:");

    // Handle different borrow scenarios based on user's choice
    switch (operation)
    {
        case 1:
            await PrintAllBooks(); // Display all books
            await BorrowById(); // Borrow by ID
            break;
        case 2:
            await PrintByGenre(); // Display books by genre
            await BorrowById(); // Borrow by ID
            break;
        case 3:
            await BorrowById(); // Directly borrow by ID
            break;
        case 4:
            await BorrowByISBN(); // Borrow by ISBN
            break;
        default:
            Console.WriteLine("Invalid option."); // Invalid choice handling
            break;
    }
}

/// <summary>
/// Allows the user to browse books. Provides different browsing criteria.
/// </summary>
```

```
private async Task Browse()
{
    ShowBrowseBooks(); // Show browsing options
    var operation = uiHelper.ReadIntInput("Please select an option:");

    // Handle different browsing scenarios based on user's choice
    switch (operation)
    {
        case 1:
            await PrintAllBooks(); // Display all books
            break;
        case 2:
            await PrintByGenre(); // Display books by genre
            break;
        case 3:
            await PrintById(); // Display books by ID
            break;
        case 4:
            await PrintByISBN(); // Display books by ISBN
            break;
        default:
            Console.WriteLine("Invalid option."); // Invalid choice handling
            break;
    }
}

/// <summary>
/// Allows the user to add a new book to the system.
/// Prompts the user for book details and validates the genre.
/// </summary>
private async Task AddBook()
{
    var book = new Book();
    book.Title = uiHelper.ReadStringInput("Please enter the book title:");
    string genre = uiHelper.ReadStringInput("Please enter the book genre:").ToLower();

    // Validate and assign the genre based on user's input
    switch (genre)
    {
        case "fiction":
            book.Genre = Genre.Fiction;
            break;
        case "non - fiction":
            book.Genre = Genre.NonFiction;
            break;
        case "fantasy":
            book.Genre = Genre.Fantasy;
            break;
```

```
                case "mystery":
                    book.Genre = Genre.Mystery;
                    break;
                case "romance":
                    book.Genre = Genre.Romance;
                    break;
                case "science fiction":
                    book.Genre = Genre.ScienceFiction;
                    break;
                case "biography":
                    book.Genre = Genre.Biography;
                    break;
                case "thriller":
                    book.Genre = Genre.Thriller;
                    break;
                case "horror":
                    book.Genre = Genre.Horror;
                    break;
                case "historical fiction":
                    book.Genre = Genre.HistoricalFiction;
                    break;
                case "health and wellness":
                    book.Genre = Genre.HealthAndWellness;
                    break;
                case "travel":
                    book.Genre = Genre.Travel;
                    break;
                case "children literature":
                    book.Genre = Genre.ChildrenLiterature;
                    break;
                default:
                    Console.WriteLine($"Genre - {genre} doesn't exist");
                    return; // Return if the genre is invalid
            }

            // Input and assign other book details
            book.PublicationDate = uiHelper.ReadDateInput("Please enter the book published
year:");
            book.ISBN = uiHelper.ReadStringInput("Please enter the book ISBN:");
            var authorId = uiHelper.ReadIntInput("Please enter the author ID:");
            var author = await authorBusiness.GetAsync(authorId);

            if (author != null)
            {
                book.AuthorID = author.Id; // Assign the author to the book
                await bookBusiness.AddAsync(book); // Add the book to the system
                Console.WriteLine($"Book {book.Title} added successfully.");
            }
```

```
        else
        {
            Console.WriteLine("Author not found.");
        }
    }

    /// <summary>
    /// Allows the user to update an existing book's details.
    /// Prompts the user for new values and validates them.
    /// </summary>
    private async Task UpdateBook()
    {
        var bookId = uiHelper.ReadIntInput("Please enter the book ID:");
        var book = await bookBusiness.GetAsync(bookId);

        if (book != null)
        {
            book.Title = uiHelper.ReadStringInput("Please enter the new book title:");
            string genre = uiHelper.ReadStringInput("Please enter the new book
genre:").ToLower();

            // Validate and assign the new genre
            switch (genre)
            {
                case "fiction":
                    book.Genre = Genre.Fiction;
                    break;
                case "non - fiction":
                    book.Genre = Genre.NonFiction;
                    break;
                // Other genre cases...
                default:
                    Console.WriteLine($"Genre - {genre} doesn't exist");
                    return;
            }

            // Input new ISBN and author details
            book.PublicationDate = uiHelper.ReadDateInput("Please enter the book published
year:");
            book.ISBN = uiHelper.ReadStringInput("Please enter the new book ISBN:");
            var authorId = uiHelper.ReadIntInput("Please enter the new author ID:");
            var author = await authorBusiness.GetAsync(authorId);

            if (author != null)
            {
                book.AuthorID = author.Id; // Assign new author to book
                await bookBusiness.AddAsync(book); // Update book details in the system
                Console.WriteLine($"Book {book.Title} updated successfully.");
            }
            else
            {
                Console.WriteLine("Author not found.");
            }
        }
        else
        {
            Console.WriteLine($"Book with ID - {bookId} doesn't exist");
        }
    }

    /// <summary>
    /// Allows the user to delete a book from the system.
    /// Prompts the user for the book ID and removes the book if found.
    /// </summary>
    private async Task DeleteBook()
    {
        var bookId = uiHelper.ReadIntInput("Please enter the book ID:");
        var book = await bookBusiness.GetAsync(bookId);

        if (book != null)
        {
            await bookBusiness.DeleteAsync(book.Id); // Delete the book from the system
            Console.WriteLine($"Book {book.Title} deleted successfully.");
        }
        else
        {
            Console.WriteLine($"Book with ID - {bookId} doesn't exist");
        }
    }

    // Print functions to display books in various formats
    /// <summary>
    /// Prints all books in the system.
    /// </summary>
    private async Task PrintAllBooks()
    {
        var books = await bookBusiness.GetAllWithIncludesAsync();
        foreach (var book in books)
        {
            Console.WriteLine($"ID: {book.Id}, Title: {book.Title}, Genre: {book.Genre},
Author: {book.Author.FirstName} {book.Author.LastName}, Release Date:
{book.PublicationDate:yyyy-MM-dd}, ISBN: {book.ISBN}");
        }
    }

    /// <summary>
```

```
        /// Prints books filtered by genre.
        /// </summary>
        private async Task PrintByGenre()
        {
            var genre = uiHelper.ReadStringInput("Please enter the genre:");
            var filteredBooks = await bookBusiness.GetAllByGenreWithIncludesAsync(genre);

            if (filteredBooks != null && filteredBooks.Count > 0)
            {
                foreach (var book in filteredBooks)
                {
                    Console.WriteLine($"ID: {book.Id}, Title: {book.Title}, Author:
{book.Author.FirstName} {book.Author.LastName}, Release Date:
{book.PublicationDate:yyyy-MM-dd}, ISBN: {book.ISBN}");
                }
            }
            else
            {
                Console.WriteLine($"Genre - {genre} doesn't exist or no books found.");
            }
        }

        /// <summary>
        /// Prints a book found by its ID.
        /// </summary>
        private async Task PrintById()
        {
            var bookId = uiHelper.ReadIntInput("Please enter the book ID:");
            var book = await bookBusiness.GetWithIncludesAsync(bookId);

            if (book != null)
            {
                Console.WriteLine($"ID: {book.Id}, Title: {book.Title}, Genre: {book.Genre},
Author: {book.Author.FirstName} {book.Author.LastName}, Release Date:
{book.PublicationDate:yyyy-MM-dd}, ISBN: {book.ISBN}");
            }
            else
            {
                Console.WriteLine($"Book with ID - {bookId} doesn't exist");
            }
        }

        /// <summary>
        /// Prints a book found by its ISBN.
        /// </summary>
        private async Task PrintByISBN()
        {
            var bookISBN = uiHelper.ReadStringInput("Please enter the book ISBN:");
```

```
          var book = await bookBusiness.GetByISBNWithIncludesAsync(bookISBN);

          if (book != null)
          {
              Console.WriteLine($"ID: {book.Id}, Title: {book.Title}, Genre: {book.Genre},
Author: {book.Author.FirstName} {book.Author.LastName}, Release Date:
{book.PublicationDate:yyyy-MM-dd}, ISBN: {book.ISBN}");
          }
          else
          {
              Console.WriteLine($"Book with ISBN - {bookISBN} doesn't exist");
          }
      }

      // Borrow functions for borrowing books by different criteria
      /// <summary>
      /// Allows the user to borrow a book by its ID.
      /// </summary>
      private async Task BorrowById()
      {
          var bookId = uiHelper.ReadIntInput("Please select a book by ID:");
          var book = await bookBusiness.GetWithIncludesAsync(bookId);

          if (book != null)
          {
              Console.WriteLine($"You selected: {book.Title}");
              var memberId = uiHelper.ReadIntInput("Please enter your member ID:");
              var member = await memberBusiness.GetAsync(memberId);

              if (member != null)
              {
                  if (book.BorrowedBooks.Any(bb => bb.ReturnDate == null))
                  {
                      Console.WriteLine($"Book {book.Title} with ID: {book.Id} is already
borrowed.");
                      return; // Book is already borrowed, exit the method
                  }
                  // Create a borrowed book record
                  var borrowedBook = new BorrowedBook
                  {
                      BookID = book.Id,
                      MemberID = member.Id,
                      BorrowDate = DateTime.Now.Date, // Current date
                      DueDate = DateTime.Now.AddMonths(2).Date // Assuming a 2-month
borrowing period
                  };
                  await borrowedBookBusiness.AddAsync(borrowedBook); // Save the borrowed
book
```

```
                Console.WriteLine($"You have successfully borrowed {book.Title}.");
            }
            else
            {
                Console.WriteLine("Member not found.");
            }
        }
        else
        {
            Console.WriteLine("Book not found.");
        }
    }

    /// <summary>
    /// Allows the user to borrow a book by its ISBN.
    /// </summary>
    private async Task BorrowByISBN()
    {
        string bookISBN = uiHelper.ReadStringInput("Please enter the book ISBN:");
        var book = await bookBusiness.GetByISBNWithIncludesAsync(bookISBN);

        if (book != null)
        {
            Console.WriteLine($"You selected: {book.Title}");
            var memberId = uiHelper.ReadIntInput("Please enter your member ID:");
            var member = await memberBusiness.GetAsync(memberId);

            if (member != null)
            {
                if (book.BorrowedBooks.Any(bb => bb.ReturnDate == null))
                {
                    Console.WriteLine($"Book {book.Title} with ID: {book.Id} is already
borrowed.");
                    return; // Book is already borrowed, exit the method
                }
                var borrowedBook = new BorrowedBook
                {
                    BookID = book.Id,
                    MemberID = member.Id,
                    BorrowDate = DateTime.Now.Date
                };
                await borrowedBookBusiness.AddAsync(borrowedBook); // Add the borrowed
book record
                Console.WriteLine($"You have successfully borrowed {book.Title}.");
            }
            else
            {
                Console.WriteLine("Member not found.");
                }
            }
            else
            {
                Console.WriteLine("Book not found.");
            }
        }
    }
}
```

Display.cs:

```
using ConsoleApp.Presentation.SubDisplays;


namespace ConsoleApp.Presentation
{
    internal class Display
    {
        // Creating instances of sub-displays for each domain (Book, Member, Author, Borrowed
Book)
        private readonly AuthorDisplay authorDisplay = new AuthorDisplay();
        private readonly BookDisplay bookDisplay = new BookDisplay();
        private readonly BorrowedBookDisplay borrowedBookDisplay = new
BorrowedBookDisplay();
        private readonly MemberDisplay memberDisplay = new MemberDisplay();

        // UI helper to assist with common input/output operations
        private readonly UIHelper uiHelper = new UIHelper();

        /// <summary>
        /// The entry point for starting the display interaction.
        /// </summary>
        public static async Task OnStart()
        {
            var display = new Display();
            await display.Input();
        }

        // Private constructor to prevent instantiation outside the class
        private Display()
        {
        }

        /// <summary>
        /// Displays the main menu options for the library management system.
        /// </summary>
        public void ShowMenu()
        {
            uiHelper.ShowHeader("Library Management System");
            Console.WriteLine("1. Books");
            Console.WriteLine("2. Members");
            Console.WriteLine("3. Authors");
            Console.WriteLine("4. Borrowed Books History");
            Console.WriteLine("5. Exit");
        }

        /// <summary>
        /// Handles the user input and navigates to the appropriate display based on selection.
        /// </summary>
        private async Task Input()
        {
            var operation = -1;
            do
            {
                ShowMenu(); // Show the menu options
                operation = uiHelper.ReadIntInput("Please select an option:"); // Read user input

                // Switch case for different menu options
                switch (operation)
                {
                    case 1:
                        await bookDisplay.BookManager(); // Navigate to book manager
                        break;
                    case 2:
                        await memberDisplay.MemberManager(); // Navigate to member manager
                        break;
                    case 3:
                        await authorDisplay.AuthorManager(); // Navigate to author manager
                        break;
                    case 4:
                        await borrowedBookDisplay.BorrowedBookManager(); // Navigate to
borrowed book manager
                        break;
                    case 5:
                        Console.WriteLine("Exiting..."); // Inform the user that the program is exiting
                        break;
                    default:
                        Console.WriteLine("Invalid option selected, please try again."); // Handle
invalid options
                        break;
                }
            } while (operation != 5); // Continue the loop until the user chooses to exit
        }
    }
```

```
}
```

UIHelper.cs:

```
namespace ConsoleApp.Presentation
{
    internal class UIHelper
    {
        /// <summary>
        /// Displays a centered header with the given title.
        /// </summary>
        /// <param name="title">The title to display in the header.</param>
        public void ShowHeader(string title)
        {
            int totalWidth = 40; // Set the header width

            Console.WriteLine(new string('-', totalWidth)); // Top border
            Console.WriteLine(title.PadLeft((totalWidth + title.Length) / 2).PadRight(totalWidth));
// Centered title
            Console.WriteLine(new string('-', totalWidth)); // Bottom border
        }

        /// <summary>
        /// Reads and returns a valid integer input from the user.
        /// Keeps prompting until a valid integer is entered.
        /// </summary>
        /// <param name="prompt">The message to display to the user.</param>
        public int ReadIntInput(string prompt)
        {
            int result;
            while (true)
            {
                Console.WriteLine(prompt);
                if (int.TryParse(Console.ReadLine(), out result) && result >= 0)
                {
                    return result;
                }
                Console.WriteLine("Invalid input. Please enter a number.");
            }
        }

        /// <summary>
        /// Reads and returns a non-empty string input from the user.
        /// Keeps prompting until a valid string is entered.
        /// </summary>
        /// <param name="prompt">The message to display to the user.</param>
        public string ReadStringInput(string prompt)
        {
            string input;
            while (true)
            {
                Console.WriteLine(prompt);
                input = Console.ReadLine();

                if (string.IsNullOrEmpty(input))
                {
                    Console.WriteLine("Input cannot be empty. Please enter a valid string.");
                    continue;
                }

                return input;
            }
        }

        /// <summary>
        /// Reads and returns a valid DateTime input from the user in dd-MM-yyyy format.
        /// Keeps prompting until a properly formatted and valid date is entered.
        /// </summary>
        /// <param name="prompt">The message to display to the user.</param>
        /// <returns>A DateTime value representing the user's input.</returns>
        public DateTime ReadDateInput(string prompt)
        {
            DateTime dateInput;
            while (true)
            {
                Console.WriteLine($"{prompt} (dd-MM-yyyy)");
                string input = Console.ReadLine();

                if (string.IsNullOrEmpty(input))
                {
                    Console.WriteLine("Input cannot be empty. Please enter a valid date.");
                    continue;
                }

                if (DateTime.TryParseExact(input, "dd-MM-yyyy",
                    System.Globalization.CultureInfo.InvariantCulture,
                    System.Globalization.DateTimeStyles.None, out dateInput))
                {
                    return dateInput;
                }
                else
                {
                    Console.WriteLine("Invalid date format. Please enter the date in dd-MM-yyyy
format.");
                }
            }
        }
    }
}
```

Test пример (BookBusinessTest):

```
using Business;
using Data;
using Data.Enums;
using Data.Models;
using Microsoft.EntityFrameworkCore;

namespace Tests
{
    public class BookBusinessTests
    {
        [Test]
        public async Task GetAllTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;

            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

                context.SaveChanges();

                BookBusiness bookBusiness = new BookBusiness(context);
                List<Book> books = await bookBusiness.GetAllAsync();

                Assert.That(books.Count, Is.EqualTo(2));
            }
        }

        [Test]
        public async Task GetAllWithIncludesTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;

            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Authors.Add(new Author { Id = 1, FirstName = "Author", LastName = "1",
Biography = "abcdefg", DateOfBirth = DateTime.Now.AddYears(-1), ImageUrl =
"randomUrl" });
                context.Authors.Add(new Author { Id = 2, FirstName = "Author", LastName = "2",
Biography = "gfedcba", DateOfBirth = DateTime.Now.AddYears(-2), ImageUrl =
"randomUrl" });

                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

                context.SaveChanges();
                BookBusiness bookBusiness = new BookBusiness(context);
                List<Book> books = await bookBusiness.GetAllWithIncludesAsync();
                Assert.That(books.Count, Is.EqualTo(2));
                Assert.That(books[0].Author, Is.Not.Null);
                Assert.That(books[0].BorrowedBooks, Is.Not.Null);
            }
        }

        [Test]
        public async Task GetAllByGenreTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;

            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });
                context.Books.Add(new Book { Id = 3, Title = "Book 3", AuthorID = 3, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-3), ISBN =
"0900000003" });
```

```
                context.SaveChanges();

                BookBusiness bookBusiness = new BookBusiness(context);
                List<Book> booksFiction = await bookBusiness.GetAllByGenreAsync("Fiction");
                List<Book> booksNonFiction = await
bookBusiness.GetAllByGenreAsync("NonFiction");

                Assert.That(booksFiction.Count, Is.EqualTo(1));
                Assert.That(booksFiction[0].Genre, Is.EqualTo(Genre.Fiction));

                Assert.That(booksNonFiction.Count, Is.EqualTo(2));
                Assert.That(booksNonFiction[0].Genre, Is.EqualTo(Genre.NonFiction));
            }
        }

        [Test]
        public async Task GetAllByGenreWithIncludesTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;

            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Authors.Add(new Author { Id = 1, FirstName = "Author", LastName = "1",
Biography = "abcdefg", DateOfBirth = DateTime.Now.AddYears(-1), ImageUrl =
"randomUrl" });
                context.Authors.Add(new Author { Id = 2, FirstName = "Author", LastName = "2",
Biography = "gfedcba", DateOfBirth = DateTime.Now.AddYears(-2), ImageUrl =
"randomUrl" });
                context.Authors.Add(new Author { Id = 3, FirstName = "Author", LastName = "3",
Biography = "gfedcba", DateOfBirth = DateTime.Now.AddYears(-3), ImageUrl =
"randomUrl" });

                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });
                context.Books.Add(new Book { Id = 3, Title = "Book 3", AuthorID = 3, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-3), ISBN =
"0900000003" });

                context.SaveChanges();
                BookBusiness bookBusiness = new BookBusiness(context);
                List<Book> booksFiction = await
bookBusiness.GetAllByGenreWithIncludesAsync("Fiction");
                List<Book> booksNonFiction = await
bookBusiness.GetAllByGenreWithIncludesAsync("NonFiction");

                Assert.That(booksFiction.Count, Is.EqualTo(1));
                Assert.That(booksFiction[0].Genre, Is.EqualTo(Genre.Fiction));

                Assert.That(booksNonFiction.Count, Is.EqualTo(2));
                Assert.That(booksNonFiction[0].Genre, Is.EqualTo(Genre.NonFiction));

                Assert.That(booksFiction[0].Author, Is.Not.Null);
                Assert.That(booksNonFiction[0].Author, Is.Not.Null);
                Assert.That(booksNonFiction[1].Author, Is.Not.Null);
            }
        }

        [Test]
        public async Task GetTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;

            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

                context.SaveChanges();

                BookBusiness bookBusiness = new BookBusiness(context);
                Book book = await bookBusiness.GetAsync(1);

                Assert.That(book, Is.Not.Null);
                Assert.That(book.Id, Is.EqualTo(1));
                Assert.That(book, Is.EqualTo(context.Books.Find(1)));
            }
        }
        [Test]
        public async Task GetWithIncludesTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;

            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Authors.Add(new Author { Id = 1, FirstName = "Author", LastName = "1",
Biography = "abcdefg", DateOfBirth = DateTime.Now.AddYears(-1), ImageUrl =
"randomUrl" });
                context.Authors.Add(new Author { Id = 2, FirstName = "Author", LastName = "2",
Biography = "gfedcba", DateOfBirth = DateTime.Now.AddYears(-2), ImageUrl =
"randomUrl" });

                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

                context.SaveChanges();

                BookBusiness bookBusiness = new BookBusiness(context);
                Book book = await bookBusiness.GetWithIncludesAsync(1);

                Assert.That(book, Is.Not.Null);
                Assert.That(book.Id, Is.EqualTo(1));
                Assert.That(book, Is.EqualTo(context.Books.Find(1)));

                Assert.That(book.Author, Is.Not.Null);
                Assert.That(book.BorrowedBooks, Is.Not.Null);

                Assert.That(book.Author, Is.EqualTo(context.Books.Include(b =>
b.Author).Include(b => b.BorrowedBooks).First(x => x.Id == 1).Author));
            }
        }

        [Test]
        public async Task GetByISBNTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;
            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

                context.SaveChanges();

                BookBusiness bookBusiness = new BookBusiness(context);
                Book book = await bookBusiness.GetByISBNAsync("0900000001");

                Assert.That(book, Is.Not.Null);
                Assert.That(book.Id, Is.EqualTo(1));
                Assert.That(book.ISBN, Is.EqualTo("0900000001"));
                Assert.That(book, Is.EqualTo(context.Books.First(x => x.ISBN ==
"0900000001")));
            }
        }

        [Test]
        public async Task GetByISBNWithIncludesTest()
        {
            var options = new DbContextOptionsBuilder<LibraryDbContext>()
            .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
            .Options;

            // Insert seed data into the database using one instance of the context

            using (var context = new LibraryDbContext(options))
            {
                context.Authors.Add(new Author { Id = 1, FirstName = "Author", LastName = "1",
Biography = "abcdefg", DateOfBirth = DateTime.Now.AddYears(-1), ImageUrl =
"randomUrl" });
                context.Authors.Add(new Author { Id = 2, FirstName = "Author", LastName = "2",
Biography = "gfedcba", DateOfBirth = DateTime.Now.AddYears(-2), ImageUrl =
"randomUrl" });

                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });
```

```
            context.SaveChanges();

            BookBusiness bookBusiness = new BookBusiness(context);
            Book book = await bookBusiness.GetByISBNWithIncludesAsync("0900000001");

            Assert.That(book, Is.Not.Null);
            Assert.That(book.Id, Is.EqualTo(1));
            Assert.That(book.ISBN, Is.EqualTo("0900000001"));
            Assert.That(book, Is.EqualTo(context.Books.First(x => x.ISBN ==
"0900000001")));

            Assert.That(book.Author, Is.Not.Null);
            Assert.That(book.BorrowedBooks, Is.Not.Null);

            Assert.That(book.Author, Is.EqualTo(context.Books.Include(b =>
b.Author).Include(b => b.BorrowedBooks).First(x => x.ISBN == "0900000001").Author));
        }
    }

    [Test]
    public async Task AddTest()
    {
        var options = new DbContextOptionsBuilder<LibraryDbContext>()
        .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
        .Options;

        // Insert seed data into the database using one instance of the context

        using (var context = new LibraryDbContext(options))
        {
            context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
            context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

            context.SaveChanges();

            BookBusiness bookBusiness = new BookBusiness(context);
            Book book = new Book { Id = 3, Title = "Book 3", AuthorID = 3, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-3), ISBN = "0900000003" };
            await bookBusiness.AddAsync(book);

            Assert.That(context.Books, Has.Exactly(1).EqualTo(book));
        }
    }
```

```
        [Test]
        public async Task UpdateTest()
        {
           var options = new DbContextOptionsBuilder<LibraryDbContext>()
           .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
           .Options;

           // Insert seed data into the database using one instance of the context

           using (var context = new LibraryDbContext(options))
           {
              context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
              context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

              context.SaveChanges();

              BookBusiness bookBusiness = new BookBusiness(context);
              Book oldBook = new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN = "0900000002" };
              Book book = new Book { Id = 2, Title = "Book 2.1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-3), ISBN = "0900000011" };
              await bookBusiness.UpdateAsync(book);

              Assert.That(context.Books, Has.Exactly(0).EqualTo(oldBook));

              Assert.That(context.Books.Count(), Is.EqualTo(2));

              Assert.That(context.Books.First(x => x.Id == 2).Title, Is.EqualTo("Book 2.1"));
              Assert.That(context.Books.First(x => x.Id == 2).PublicationDate,
Is.EqualTo(context.Books.Find(2).PublicationDate));
              Assert.That(context.Books.First(x => x.Id == 2).ISBN, Is.EqualTo("0900000011"));
              Assert.That(context.Books.First(x => x.Id == 2).Genre, Is.EqualTo(Genre.Fiction));
           }
        }

        [Test]
        public async Task DeleteTest()
        {
           var options = new DbContextOptionsBuilder<LibraryDbContext>()
           .UseInMemoryDatabase(databaseName: Guid.NewGuid().ToString())
           .Options;

           // Insert seed data into the database using one instance of the context
```

```
            using (var context = new LibraryDbContext(options))
            {
                context.Books.Add(new Book { Id = 1, Title = "Book 1", AuthorID = 1, Genre =
Genre.Fiction, PublicationDate = DateTime.Now.AddYears(-1), ISBN = "0900000001" });
                context.Books.Add(new Book { Id = 2, Title = "Book 2", AuthorID = 2, Genre =
Genre.NonFiction, PublicationDate = DateTime.Now.AddYears(-2), ISBN =
"0900000002" });

                context.SaveChanges();

                BookBusiness bookBusiness = new BookBusiness(context);
                await bookBusiness.DeleteAsync(2);

                Assert.That(context.Books, Has.Exactly(0).EqualTo(context.Books.Find(2)));

                Assert.That(context.Books.Count(), Is.EqualTo(1));
            }
        }
    }
}
```

Controller пример (BookController):

```
using Business;
using Data;
using Data.Models;
using Microsoft.AspNetCore.Mvc;
using Microsoft.AspNetCore.Mvc.Rendering;

namespace WebApp.Controllers
{
    public class BooksController : Controller
    {
        private readonly BookBusiness _bookBusiness;
        private readonly AuthorBusiness _authorBusiness;

        public BooksController(LibraryDbContext context)
        {
            _authorBusiness = new AuthorBusiness(context);
            _bookBusiness = new BookBusiness(context);
        }

        // GET: /Books
        public async Task<IActionResult> Index()
        {
```

```
        var books = await _bookBusiness.GetAllWithIncludesAsync();
        return View(books);
    }

    // GET: /Books/Details/5
    public async Task<IActionResult> Details(int id)
    {
        var book = await _bookBusiness.GetWithIncludesAsync(id);
        if (book == null)
            return NotFound();

        return View(book);
    }

    // GET: /Books/Create
    public async Task<IActionResult> Create()
    {
        ViewData["AuthorId"] = new SelectList(
    _authorBusiness.GetAllAsync().Result.Select(a => new SelectListItem
    {
        Value = a.Id.ToString(),
        Text = $"{a.FirstName} {a.LastName}" // Concatenating FirstName and LastName
    }),
    "Value", "Text");

        return View();
    }



    // POST: /Books/Create
    [HttpPost]
    [ValidateAntiForgeryToken]
    public async Task<IActionResult> Create(Book book)
    {
        if (ModelState.IsValid)
        {
            await _bookBusiness.AddAsync(book);
            return RedirectToAction(nameof(Index));
        }
        return View(book);
    }

    // GET: /Books/Edit/5
    public async Task<IActionResult> Edit(int id)
    {
        var book = await _bookBusiness.GetWithIncludesAsync(id);
        if (book == null)
```

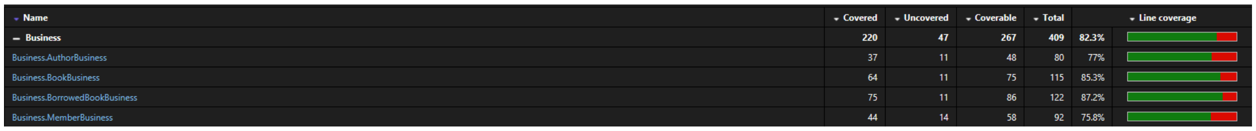
```
                return NotFound();

            ViewData["AuthorId"] = new SelectList(
        _authorBusiness.GetAllAsync().Result.Select(a => new SelectListItem
        {
            Value = a.Id.ToString(),
            Text = $"{a.FirstName} {a.LastName}" // Concatenating FirstName and LastName
        }),
        "Value", "Text");

            return View(book);
        }

        // POST: /Books/Edit/5
        [HttpPost]
        [ValidateAntiForgeryToken]
        public async Task<IActionResult> Edit(Book book)
        {
            if (ModelState.IsValid)
            {
                await _bookBusiness.UpdateAsync(book);
                return RedirectToAction(nameof(Index));
            }
            return View(book);
        }

        // GET: /Books/Delete/5
        public async Task<IActionResult> Delete(int id)
        {
            var book = await _bookBusiness.GetWithIncludesAsync(id);
            if (book == null)
                return NotFound();

            return View(book);
        }

        // POST: /Books/Delete/5
        [HttpPost, ActionName("Delete")]
        [ValidateAntiForgeryToken]
        public async Task<IActionResult> DeleteConfirmed(int id)
        {
            await _bookBusiness.DeleteAsync(id);
            return RedirectToAction(nameof(Index));
        }
    }
}
```

DbSeeder.cs:

```
using Data; using Data.Enums; using Data.Models; using Microsoft.EntityFrameworkCore;

namespace WebApp.Seeders { public class DbSeeder { private readonly LibraryDbContext
_context; public DbSeeder(LibraryDbContext context) { _context = context; }

   public async Task Seed()
    {
        await _context.Database.EnsureDeletedAsync();
        await _context.Database.EnsureCreatedAsync();

        // Create Lists for seed data
        var authors = new List<Author>
        {
            new Author { FirstName = "George", LastName = "Orwell",
DateOfBirth = new DateTime(1903, 6, 25), Biography = "British
novelist and essayist", ImageUrl =
"https://upload.wikimedia.org/wikipedia/commons/thumb/7/7e/George_Orw
ell_press_photo.jpg/1024px-George_Orwell_press_photo.jpg"},
            new Author { FirstName = "Jane", LastName = "Austen",
DateOfBirth = new DateTime(1775, 12, 16), Biography = "Renowned
English novelist", ImageUrl =
"https://upload.wikimedia.org/wikipedia/commons/thumb/c/cc/CassandraA
usten-JaneAusten%28c.1810%29_hires.jpg/1024px-CassandraAusten-
JaneAusten%28c.1810%29_hires.jpg" },
            new Author { FirstName = "J.K.", LastName = "Rowling",
DateOfBirth = new DateTime(1965, 7, 31), Biography = "Author of Harry
Potter series", ImageUrl =
"https://upload.wikimedia.org/wikipedia/commons/thumb/5/5d/J._K._Rowl
ing_2010.jpg/250px-J._K._Rowling_2010.jpg"},
            new Author { FirstName = "Stephen", LastName = "King",
DateOfBirth = new DateTime(1947, 9, 21), Biography = "King of horror
and supernatural fiction", ImageUrl =
"https://upload.wikimedia.org/wikipedia/commons/thumb/2/24/Stephen_Ki
ng_at_the_2024_Toronto_International_Film_Festival_2_%28cropped%29.jp
g/250px-
Stephen_King_at_the_2024_Toronto_International_Film_Festival_2_%28cro
pped%29.jpg" },
            new Author { FirstName = "Mark", LastName = "Twain",
DateOfBirth = new DateTime(1835, 11, 30), Biography = "Famous
American humorist and writer", ImageUrl =
"https://upload.wikimedia.org/wikipedia/commons/0/0c/Mark_Twain_by_AF
_Bradley.jpg"}
```

```
        };

        var members = new List<Member>
        {
            new Member { FirstName = "Alice", LastName = "Johnson",
MembershipExpireDate = new DateTime(2026, 5, 1), PhoneNumber = "555-
12345678" },
            new Member { FirstName = "Bob", LastName = "Smith",
MembershipExpireDate = new DateTime(2026, 4, 15), PhoneNumber = "555-
87654321" },
            new Member { FirstName = "Carol", LastName = "Martinez",
MembershipExpireDate = new DateTime(2026, 7, 30), PhoneNumber = "555-
56789012" },
            new Member { FirstName = "Dave", LastName = "Brown",
MembershipExpireDate = new DateTime(2024, 3, 10), PhoneNumber = "555-
43210987" }, // EXPIRED
            new Member { FirstName = "Eve", LastName = "Davis",
MembershipExpireDate = new DateTime(2026, 9, 20), PhoneNumber = "555-
34567890" }
        };

        // Insert Authors and save changes
        await _context.Authors.AddRangeAsync(authors);
        await _context.SaveChangesAsync(); // Save authors to
generate IDs

        // Retrieve authors with their IDs
        var authorList = await _context.Authors.ToListAsync();

        // Now that we have the author IDs, create books and link
them to the correct author IDs
        var books = new List<Book>
        {
            new Book { Title = "1984", Genre = Genre.ScienceFiction,
ISBN = "9780451524935", PublicationDate = new DateTime(1949, 6, 8),
AuthorID = 1},
            new Book { Title = "Animal Farm", Genre = Genre.Fiction,
ISBN = "9780451526342", PublicationDate = new DateTime(1945, 8, 17),
AuthorID = 1},
            new Book { Title = "Pride and Prejudice", Genre =
Genre.Romance, ISBN = "9780679783268", PublicationDate = new
DateTime(1813, 1, 28), AuthorID = 2},
            new Book { Title = "Sense and Sensibility", Genre =
Genre.Romance, ISBN = "9780141439662", PublicationDate = new
DateTime(1811, 10, 30), AuthorID = 2},
            new Book { Title = "Harry Potter and the Sorcerer's
Stone", Genre = Genre.Fantasy, ISBN = "9780439554930",
PublicationDate = new DateTime(1997, 6, 26), AuthorID = 3},
            new Book { Title = "Harry Potter and the Chamber of
Secrets", Genre = Genre.Fantasy, ISBN = "9780439064873",
PublicationDate = new DateTime(1998, 7, 2), AuthorID = 3},
            new Book { Title = "The Shining", Genre = Genre.Horror,
ISBN = "9780385121675", PublicationDate = new DateTime(1977, 1, 28),
AuthorID = 4},
            new Book { Title = "It", Genre = Genre.Horror, ISBN =
"9780451169518", PublicationDate = new DateTime(1986, 9, 15),
AuthorID = 4},
            new Book { Title = "Adventures of Huckleberry Finn",
Genre = Genre.HistoricalFiction, ISBN = "9780486280615",
PublicationDate = new DateTime(1884, 12, 10), AuthorID = 4},
            new Book { Title = "The Adventures of Tom Sawyer", Genre
= Genre.HistoricalFiction, ISBN = "9780486400778", PublicationDate =
new DateTime(1876, 6, 1), AuthorID = 4}
        };

        // Insert Members and save changes
        await _context.Members.AddRangeAsync(members);
        await _context.SaveChangesAsync(); // Save members to
generate IDs

        // Insert Books and save changes
        await _context.Books.AddRangeAsync(books);
        await _context.SaveChangesAsync(); // Save books to generate
BookIDs

        // Create and insert Borrowed Books
        var borrowedBooks = new List<BorrowedBook>
        {
            new BorrowedBook { BookID = books[0].Id, MemberID =
members[0].Id, BorrowDate = new DateTime(2025, 4, 1), DueDate = new
DateTime(2025, 4, 15), ReturnDate = new DateTime(2025, 4, 10) },
            new BorrowedBook { BookID = books[1].Id, MemberID =
members[0].Id, BorrowDate = new DateTime(2025, 4, 20), DueDate = new
DateTime(2025, 5, 4), ReturnDate = null },
            new BorrowedBook { BookID = books[2].Id, MemberID =
members[1].Id, BorrowDate = new DateTime(2025, 3, 15), DueDate = new
DateTime(2025, 3, 29), ReturnDate = new DateTime(2025, 3, 28) },
            new BorrowedBook { BookID = books[3].Id, MemberID =
members[1].Id, BorrowDate = new DateTime(2025, 4, 5), DueDate = new
DateTime(2025, 4, 19), ReturnDate = null },
            new BorrowedBook { BookID = books[4].Id, MemberID =
members[2].Id, BorrowDate = new DateTime(2025, 2, 10), DueDate = new
DateTime(2025, 2, 24), ReturnDate = new DateTime(2025, 2, 25) },
            new BorrowedBook { BookID = books[5].Id, MemberID =
members[2].Id, BorrowDate = new DateTime(2025, 4, 10), DueDate = new
DateTime(2025, 4, 24), ReturnDate = null },
            new BorrowedBook { BookID = books[6].Id, MemberID =
members[3].Id, BorrowDate = new DateTime(2025, 3, 1), DueDate = new
DateTime(2025, 3, 15), ReturnDate = new DateTime(2025, 3, 12) },
            new BorrowedBook { BookID = books[7].Id, MemberID =
members[4].Id, BorrowDate = new DateTime(2025, 3, 20), DueDate = new
DateTime(2025, 4, 3), ReturnDate = new DateTime(2025, 4, 1) },
            new BorrowedBook { BookID = books[8].Id, MemberID =
members[4].Id, BorrowDate = new DateTime(2025, 4, 18), DueDate = new
DateTime(2025, 5, 2), ReturnDate = null }
        };

        // Insert Borrowed Books and save changes
        await _context.BorrowedBooks.AddRangeAsync(borrowedBooks);
        await _context.SaveChangesAsync(); // Save borrowed books
    }
}
```

Покритие на тестовете върху business слоя



Name	Covered	Uncovered	Coverable	Total		Line coverage
Business	**220**	**47**	**267**	**409**	**82.3%**	🟩🟥
Business.AuthorBusiness	37	11	48	80	77%	🟩🟥
Business.BookBusiness	64	11	75	115	85.3%	🟩🟥
Business.BorrowedBookBusiness	75	11	86	122	87.2%	🟩🟥
Business.MemberBusiness	44	14	58	92	75.8%	🟩🟥

V. Развитие и нововъведения

Към проекта може да се добави Windows Form интерфейс, както и да се надгради с профили в системата, като има различни нива потребители. Така приложенията ще могат да се ползват и от потребителите онлайн за да заемат книги, проверяват наличности и др. данни от дома си.

VI. Заключение

В хода на разработката на проекта успях да приложа на практика знанията си от Модул 7, свързани с разработката на многослойни приложения, бази данни и уеб технологии. Чрез реализирането на библиотечната система изградих пълно функционално приложение с няколко интерфейса (конзолен и уеб), валидирана бизнес логика и автоматизирани тестове. Работата по проекта ми помогна да усъвършенствам уменията си в работата с Entity Framework Core, ASP.NET MVC, тестове с NUnit, както и в изграждането на добре структурирана и мащабируема архитектура. Смятам, че проектът изпълнява поставените цели и демонстрира ключови практики в реалната софтуерна разработка.

VII. Използвана литература

1. Microsoft Docs – Entity Framework Core Documentation
2. Microsoft Docs – ASP.NET Core MVC Documentation
3. Microsoft Docs – Razor Pages Documentation
4. Microsoft Docs – Unit Testing in .NET
5. NUnit Documentation – https://nunit.org