SUPERSET ID: 6364957
JWT Microservice Implementation

Part 1: Project Setup

Step 1: Creating Project

Create and open the project:

```
dotnet new webapi -n JwtMicroservice
cd JwtMicroservice
code .
```

Step 2: Installing Required Packages

In the terminal:

```
dotnet add package Microsoft.AspNetCore.Authentication.JwtBearer
dotnet add package System.IdentityModel.Tokens.Jwt
```

Part 2: Assignment 1 – Basic JWT Authentication

Step 3: Creating the Models

- Creating a `Models` folder.
- Adding `LoginModel.cs`:

```
namespace JwtMicroservice.Models
{
    public class LoginModel
    {
        public string Username { get; set; } = string.Empty;
        public string Password { get; set; } = string.Empty;
    }
}
```

- Adding `User.cs`:

```
namespace JwtMicroservice.Models
{
    public class User
```

```
    {
        public int Id { get; set; }
        public string Username { get; set; } = string.Empty;
        public string Password { get; set; } = string.Empty;
        public string Role { get; set; } = string.Empty;
    }
}
```

Step 4: Updating appsettings.json

Replacing contents with:

```
{
  "Logging": {
    "LogLevel": {
      "Default": "Information",
      "Microsoft.AspNetCore": "Warning"
    }
  },
  "AllowedHosts": "*",
  "Jwt": {
    "Key": "ThisIsASecretKeyForJwtTokenWithAtLeast256Bits",
    "Issuer": "MyAuthServer",
    "Audience": "MyApiUsers",
    "DurationInMinutes": 60
  }
}
```

Step 5: Configure JWT Authentication (`Program.cs`)

Replacing contents with:

```
using Microsoft.AspNetCore.Authentication.JwtBearer;
using Microsoft.IdentityModel.Tokens;
using System.Text;

var builder = WebApplication.CreateBuilder(args);

builder.Services.AddControllers();
builder.Services.AddEndpointsApiExplorer();
builder.Services.AddSwaggerGen();

builder.Services.AddAuthentication(JwtBearerDefaults.AuthenticationScheme)
```

```
    .AddJwtBearer(options =>
    {
        options.TokenValidationParameters = new TokenValidationParameters
        {
            ValidateIssuer = true,
            ValidateAudience = true,
            ValidateLifetime = true,
            ValidateIssuerSigningKey = true,
            ValidIssuer = builder.Configuration["Jwt:Issuer"],
            ValidAudience = builder.Configuration["Jwt:Audience"],
            IssuerSigningKey = new SymmetricSecurityKey(
                Encoding.UTF8.GetBytes(builder.Configuration["Jwt:Key"]!))
        };
    });

builder.Services.AddAuthorization();

var app = builder.Build();

if (app.Environment.IsDevelopment())
{
    app.UseSwagger();
    app.UseSwaggerUI();
}

app.UseHttpsRedirection();
app.UseAuthentication();
app.UseAuthorization();

app.MapControllers();
app.Run();
```

Step 6: AuthController

- Creating `Controllers/AuthController.cs`:

```
using Microsoft.AspNetCore.Mvc;
using Microsoft.IdentityModel.Tokens;
using System.IdentityModel.Tokens.Jwt;
using System.Security.Claims;
using System.Text;
using JwtMicroservice.Models;

namespace JwtMicroservice.Controllers
```

```
{
  [ApiController]
  [Route("api/[controller]")]
  public class AuthController : ControllerBase
  {
    private readonly IConfiguration _configuration;

    public AuthController(IConfiguration configuration)
    {
      _configuration = configuration;
    }

    [HttpPost("login")]
    public IActionResult Login([FromBody] LoginModel model)
    {
      if (IsValidUser(model))
      {
        var token = GenerateJwtToken(model.Username);
        return Ok(new { Token = token, Message = "Login successful" });
      }
      return Unauthorized(new { Message = "Invalid username or password" });
    }

    private bool IsValidUser(LoginModel model)
    {
      return model.Username == "admin" && model.Password == "password123";
    }

    private string GenerateJwtToken(string username)
    {
      var claims = new[]
      {
        new Claim(ClaimTypes.Name, username),
        new Claim(ClaimTypes.NameIdentifier, "1"),
        new Claim(JwtRegisteredClaimNames.Jti, Guid.NewGuid().ToString())
      };

      var key = new SymmetricSecurityKey(
        Encoding.UTF8.GetBytes(_configuration["Jwt:Key"]!));
      var creds = new SigningCredentials(key, SecurityAlgorithms.HmacSha256);

      var token = new JwtSecurityToken(
        issuer: _configuration["Jwt:Issuer"],
        audience: _configuration["Jwt:Audience"],
        claims: claims,
```

```
            expires: DateTime.Now.AddMinutes(
                Convert.ToDouble(_configuration["Jwt:DurationInMinutes"])),
            signingCredentials: creds);

        return new JwtSecurityTokenHandler().WriteToken(token);
    }
  }
}
```

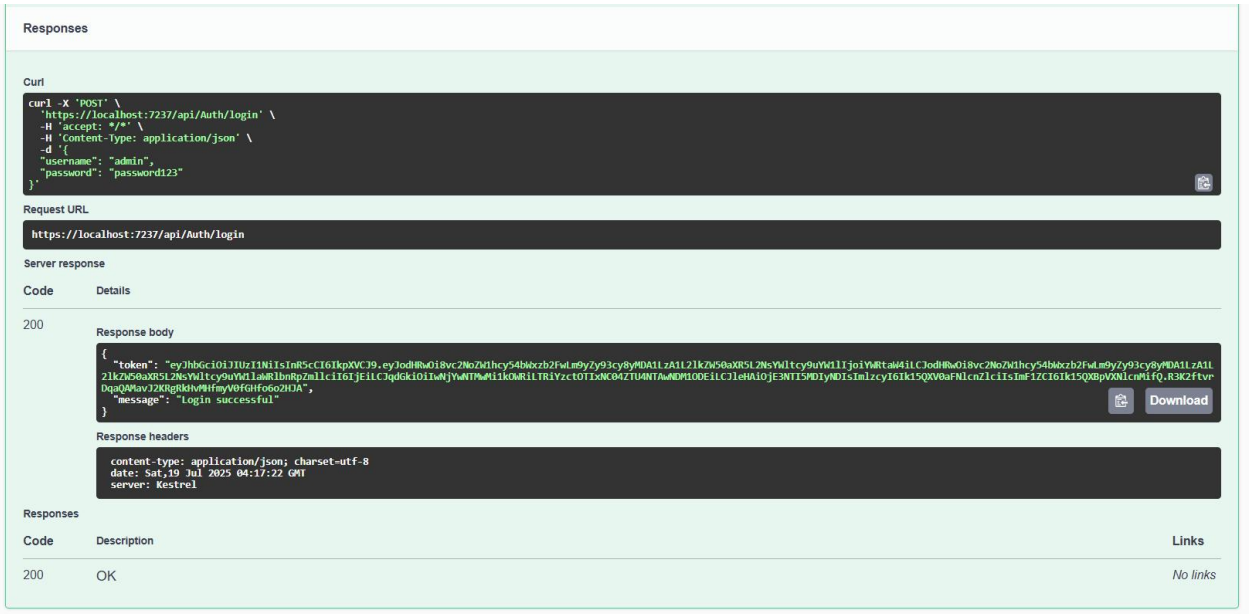
Step 7: Testing Authentication

- Runing with:

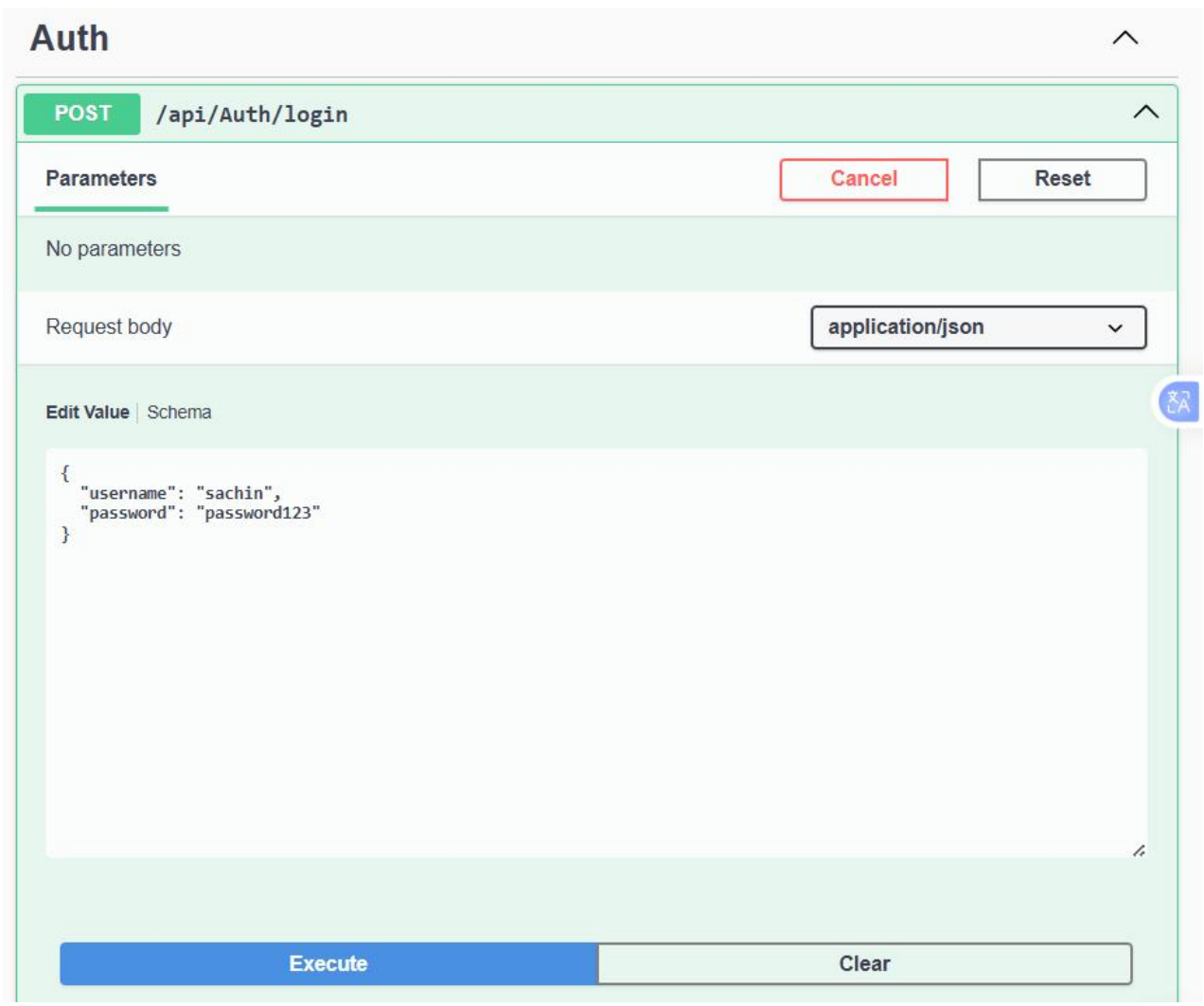
```
dotnet run
```

- Going to `https://localhost:7237/swagger`.
- Testing login by clicking “Try it out” at `POST /api/Auth/login` with JSON:

Execution Result:



- Testing with incorrect credentials to get an unauthorized error.



Execution Result:

Part 3: Assignment 2 – Secure Endpoints

Step 8: SecureController

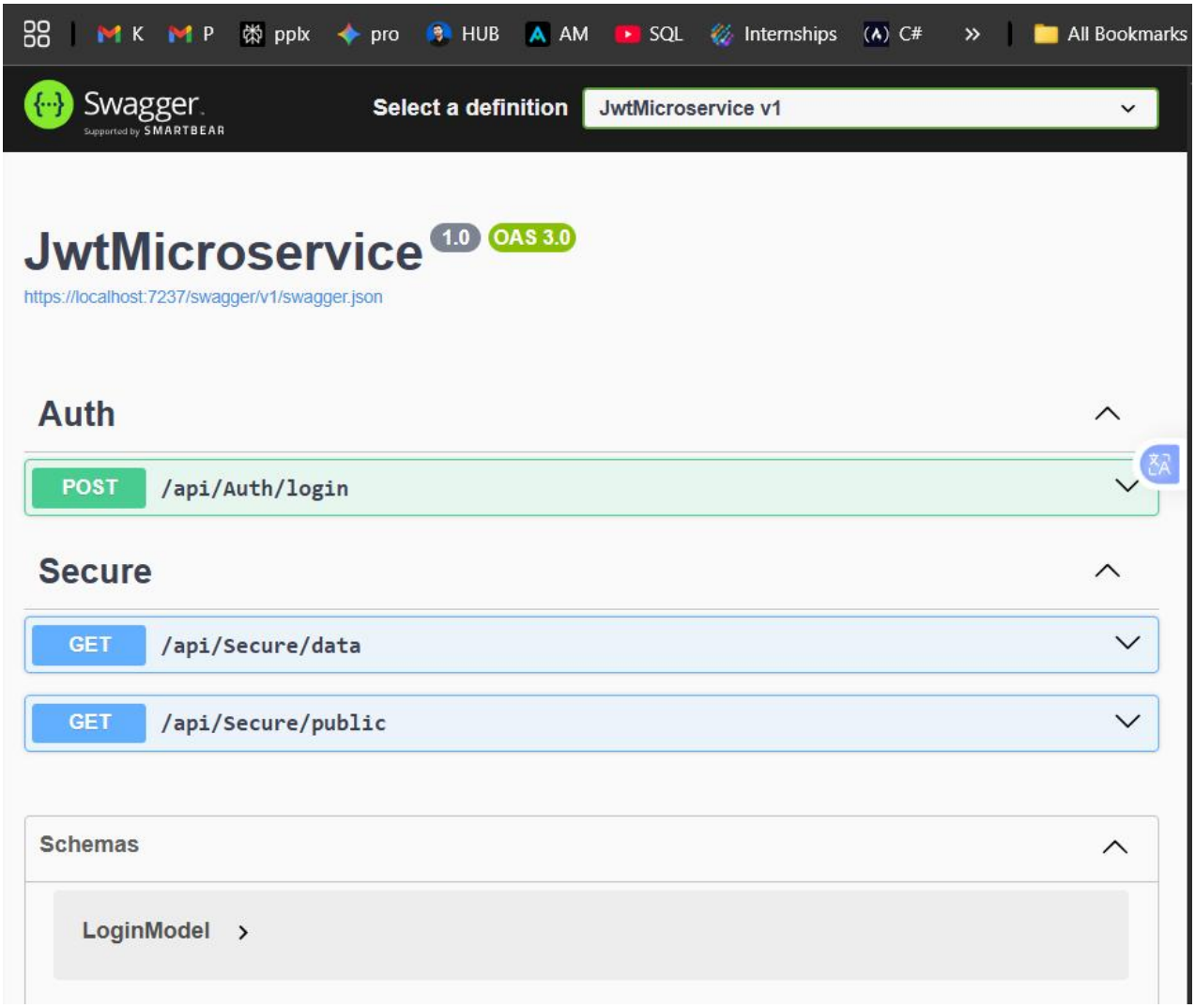
- Creating `Controllers/SecureController.cs`:

```
using Microsoft.AspNetCore.Authorization;
using Microsoft.AspNetCore.Mvc;
using System.Security.Claims;

namespace JwtMicroservice.Controllers
{
    [ApiController]
    [Route("api/[controller]")]
    public class SecureController : ControllerBase
    {
        [HttpGet("data")]
        [Authorize]
        public IActionResult GetSecureData()
        {
            var username = User.FindFirst(ClaimTypes.Name)?.Value;
            return Ok(new {
                Message = "This is protected data.",
                User = username,
                Timestamp = DateTime.Now
            });
        }

        [HttpGet("public")]
```

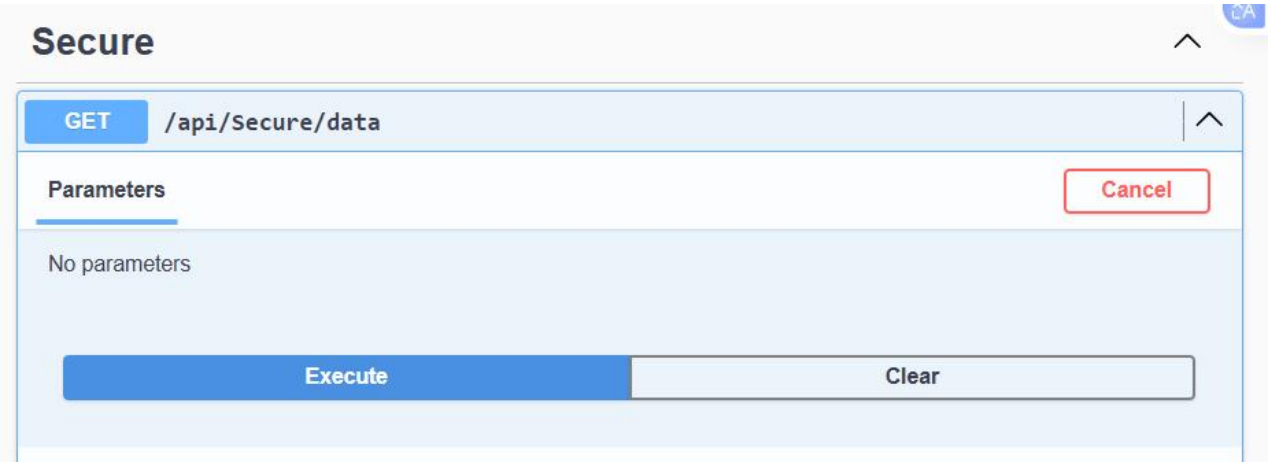
```
    public IActionResult GetPublicData()
    {
        return Ok(new {
            Message = "This is public data - no authentication required",
            Timestamp = DateTime.Now
        });
    }
  }
}
```

Step 9: Testing Secure Endpoints

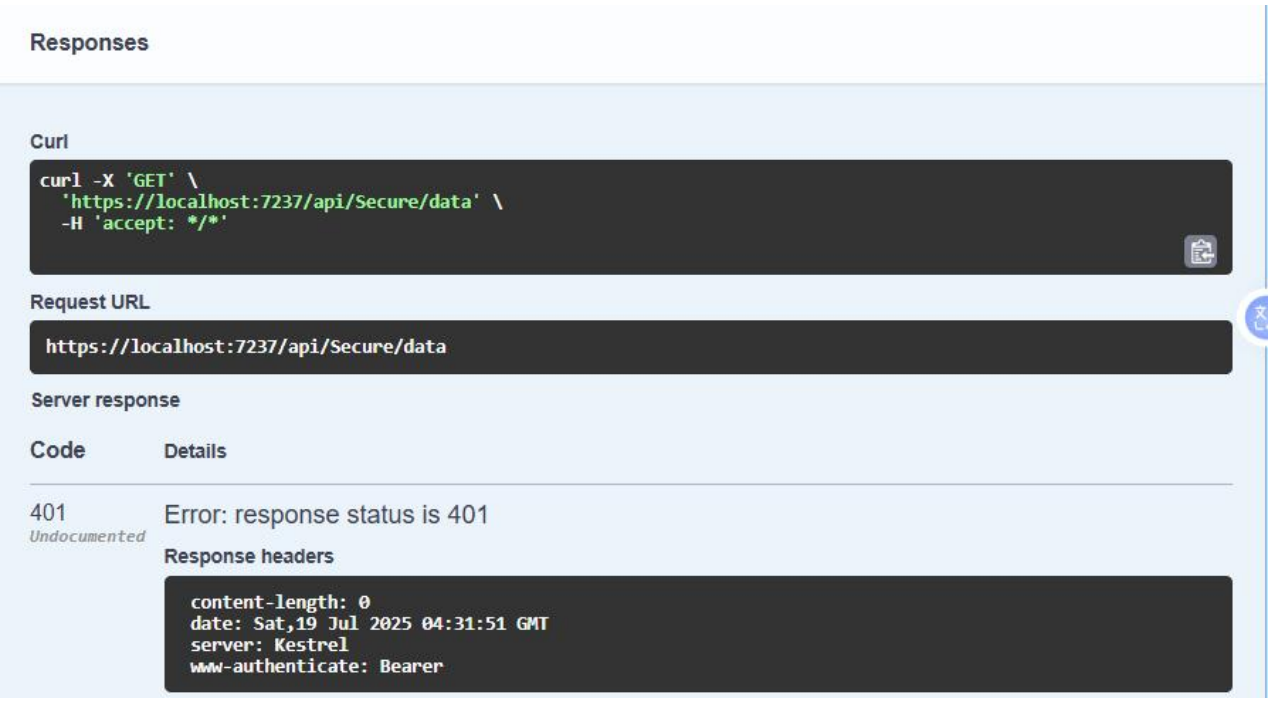
- Restarting the application.
- Going to Swagger.



- Testing `/api/Secure/data` without a token:



Execution Result:



- Logging via Auth endpoint,

Execute | Clear

Responses

Curl

```
curl -X 'POST' \
  'https://localhost:7237/api/Auth/login' \
  -H 'accept: */*' \
  -H 'Content-Type: application/json' \
  -d '{
  "username": "admin",
  "password": "password123"
}'
```

Request URL

```
https://localhost:7237/api/Auth/login
```

Server response

Code	Details
200	Response body

Translate


```
{
  "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJodHRwOi8vc2NoZW1hcy54bWxzb2FwLm9yZy93cy8yMDA1LzA1L2lkZW50aXR5L2NsYW1tcy9uYW1lIjoiYWRtaW4iLCJodHRwOi8vc2NoZW1hcy54bWxzb2FwLm9yZy93cy8yMDA1LzA1L2lkZW50aXR5L2NsYW1tcy9uYW1laWRlbnRpZml1ciI6IjEiLCJqdGkiOiJjMDV1ZDJmZi02MWE0LTRjNDItOGRiYi0wYWM3OWMwZjU0MjgiLCJleHAiOjE3NTI5MDQ0NTQsImlzcyI6Ik15QXV0aFN1cnZlciIsImF1ZCI6Ik15QXBpVXNlcnMifQ.SJ5B15KrM8cn09XjBQ0r_OttJ7u73EOcmMzcAyAKfT0",
  "message": "Login successful"
}
```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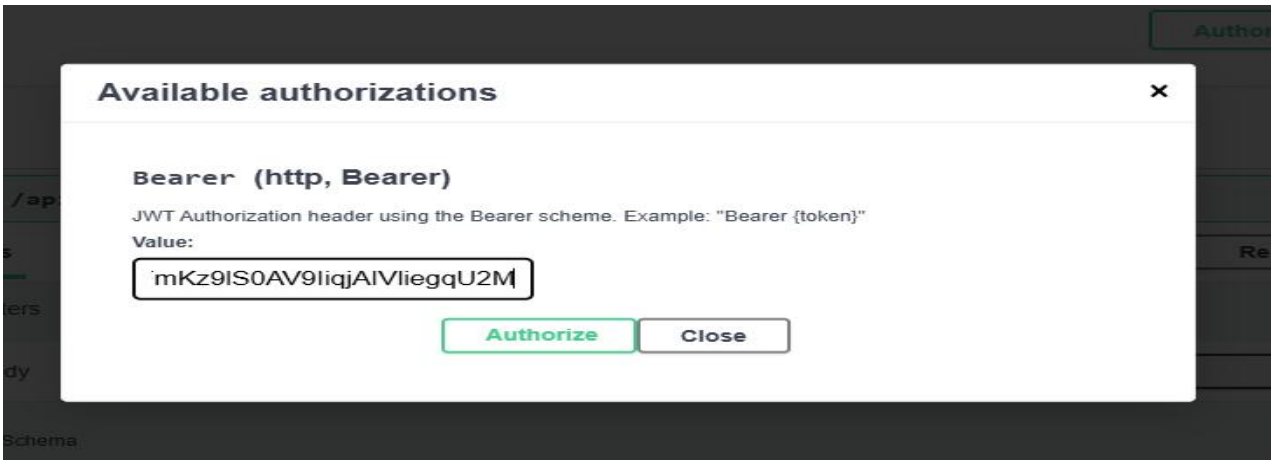
Response headers

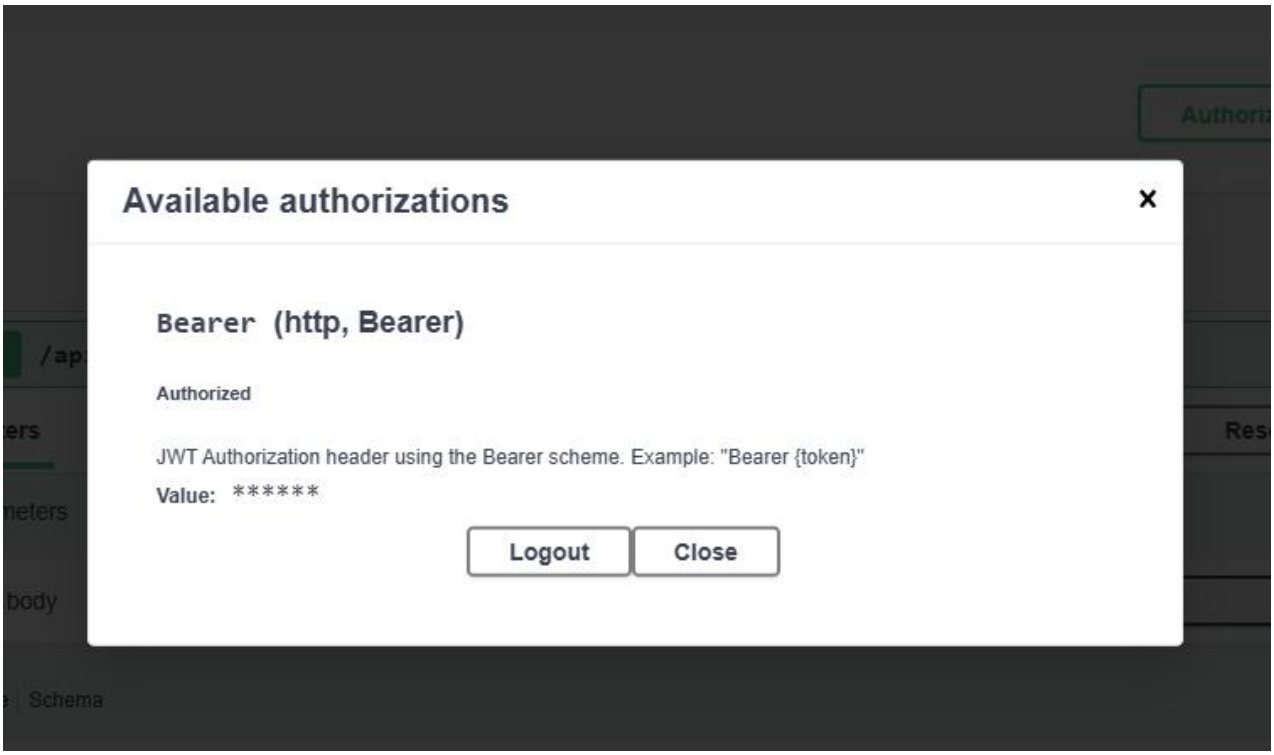
```
content-type: application/json; charset=utf-8
date: Sat,19 Jul 2025 04:54:14 GMT
server: Kestrel
```

Responses

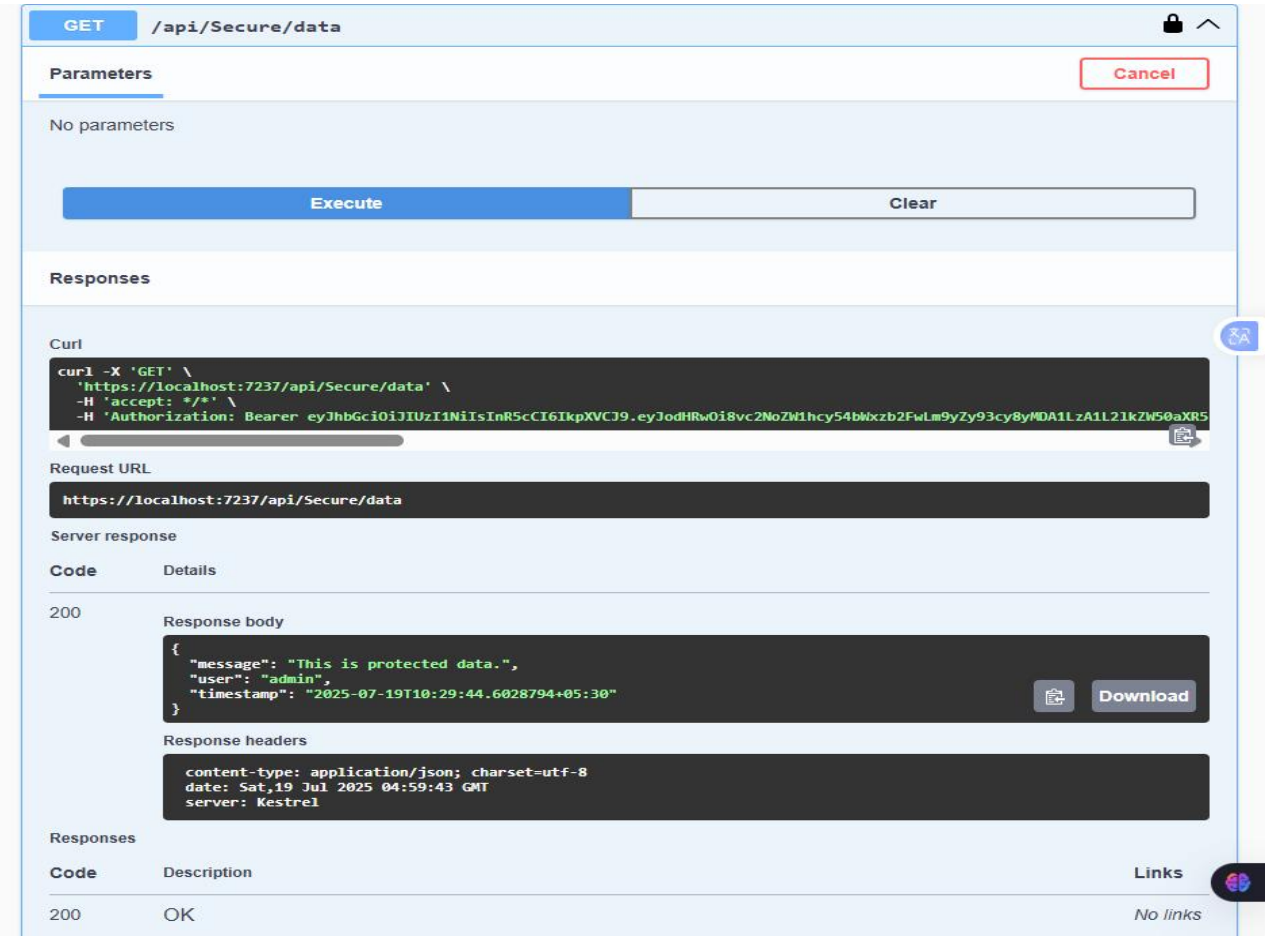
Code	Description	Links
200	OK	*No links*

- using the token to authorize, and retrying:

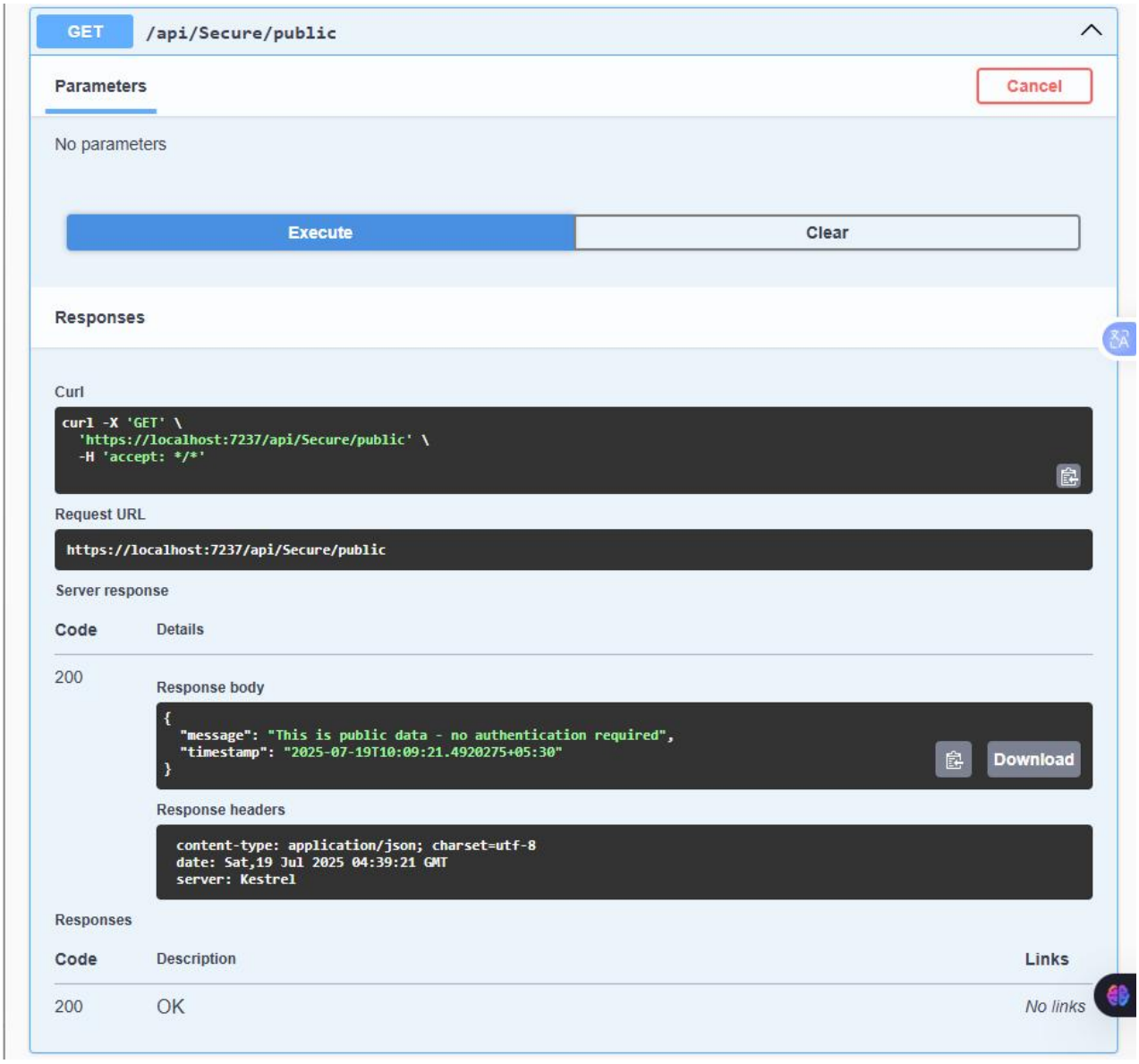




Execution REUSLT for /api/Secure/data with a Bearer token:



- Checking if works without a token `/api/Secure/public`



Part 4: Assignment 3 – Role-Based Authorization

Step 10: Updating AuthController for Roles

Replacing the relevant methods in `AuthController.cs`:

```
private bool IsValidUser(LoginModel model)
{
    var validUsers = new Dictionary<string, string>
    {
        { "admin", "password123" },
```

```
        { "user", "userpass" }
    };

    return validUsers.ContainsKey(model.Username) &&
           validUsers[model.Username] == model.Password;
}

private string GenerateJwtToken(string username)
{
    var role = GetUserRole(username);
    var claims = new[]
    {
        new Claim(ClaimTypes.Name, username),
        new Claim(ClaimTypes.NameIdentifier, "1"),
        new Claim(ClaimTypes.Role, role),
        new Claim(JwtRegisteredClaimNames.Jti, Guid.NewGuid().ToString())
    };

    var key = new SymmetricSecurityKey(
        Encoding.UTF8.GetBytes(_configuration["Jwt:Key"]!));
    var creds = new SigningCredentials(key, SecurityAlgorithms.HmacSha256);

    var token = new JwtSecurityToken(
        issuer: _configuration["Jwt:Issuer"],
        audience: _configuration["Jwt:Audience"],
        claims: claims,
        expires: DateTime.Now.AddMinutes(
            Convert.ToDouble(_configuration["Jwt:DurationInMinutes"])),
        signingCredentials: creds);

    return new JwtSecurityTokenHandler().WriteToken(token);
}

private string GetUserRole(string username)
{
    return username switch
    {
        "admin" => "Admin",
        "user" => "User",
        _ => "User"
    };
}
```

Step 11: AdminController

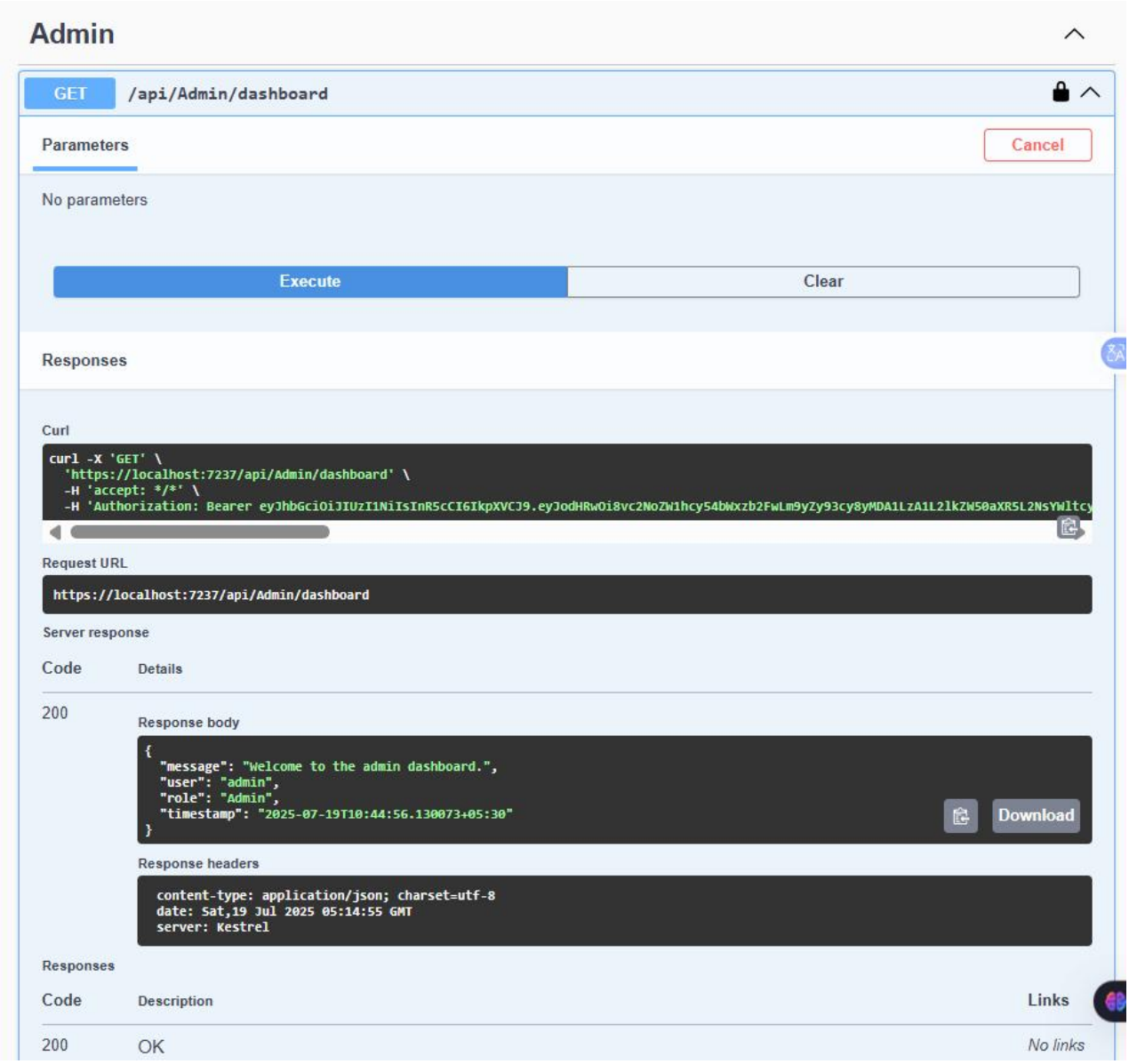
Creating `Controllers/AdminController.cs`:

```
using Microsoft.AspNetCore.Authorization;
using Microsoft.AspNetCore.Mvc;
using System.Security.Claims;

namespace JwtMicroservice.Controllers
{
    [ApiController]
    [Route("api/[controller]")]
    public class AdminController : ControllerBase
    {
        [HttpGet("dashboard")]
        [Authorize(Roles = "Admin")]
        public IActionResult GetAdminDashboard()
        {
            var username = User.FindFirst(ClaimTypes.Name)?.Value;
            var role = User.FindFirst(ClaimTypes.Role)?.Value;

            return Ok(new {
                Message = "Welcome to the admin dashboard.",
                User = username,
                Role = role,
                Timestamp = DateTime.Now
            });
        }

        [HttpGet("users")]
        [Authorize(Roles = "Admin")]
        public IActionResult GetAllUsers()
        {
            return Ok(new {
                Message = "List of all users (Admin only)",
                Users = new[] { "admin", "user1", "user2" }
            });
        }

        [HttpGet("settings")]
        [Authorize(Roles = "Admin,User")]
        public IActionResult GetSettings()
        {
            var role = User.FindFirst(ClaimTypes.Role)?.Value;
            return Ok(new {
                Message = "Settings accessible by Admin and User roles",
                YourRole = role
```

```
        });
      }
    }
}
```

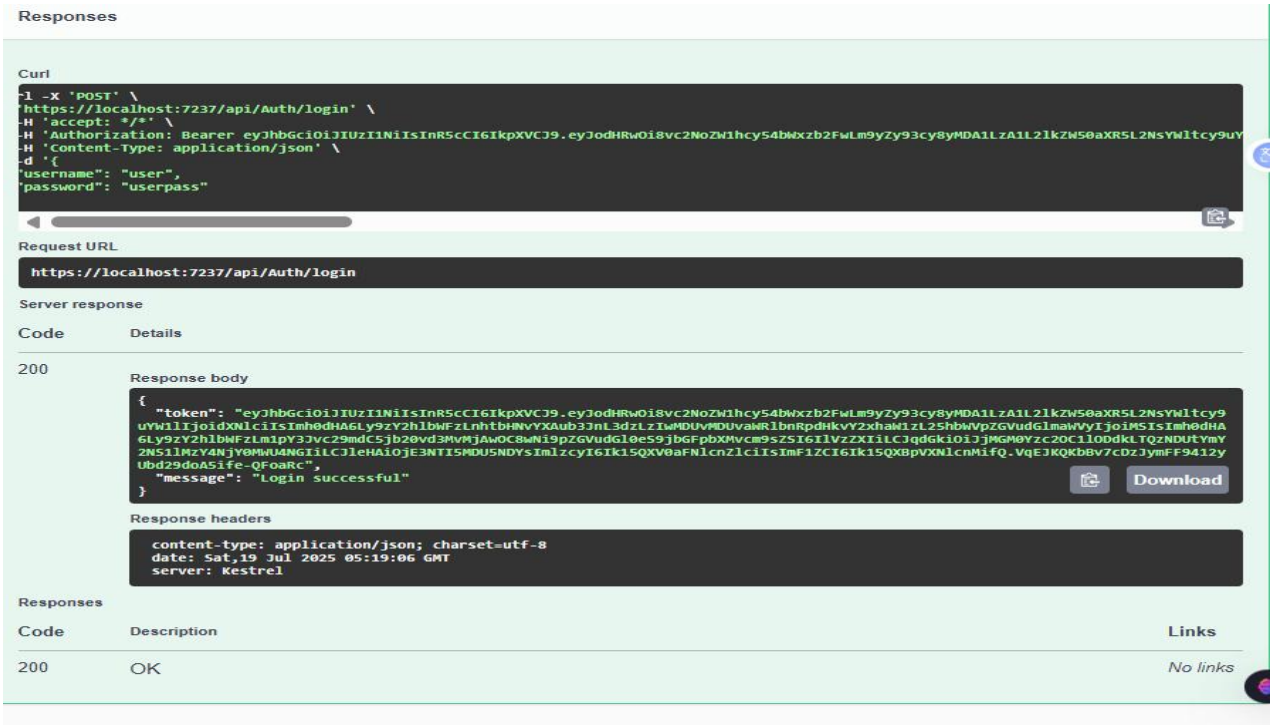
Step 12: Testing Role Authorization

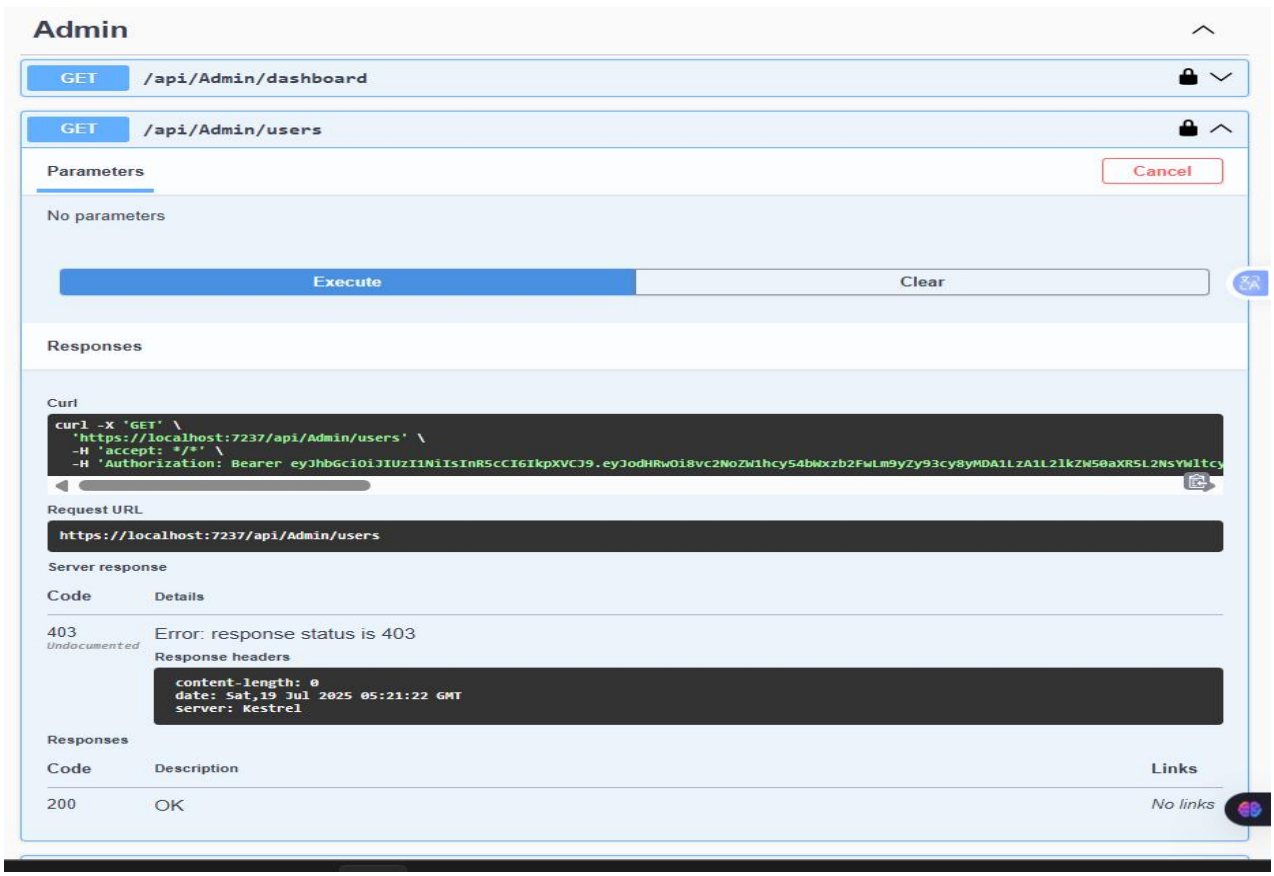
- Logging in as **admin**: access `/api/Admin/dashboard` .



- Logging in as **user**: access /api/Admin/dashboard (**should get 403 Forbidden**).

  Execution Result:





- Both roles can access /api/Admin/settings.

  Execution RESULT:

- **User Role**

Responses

Curl

```
curl -X 'GET' \
  'https://localhost:7237/api/Admin/settings' \
  -H 'accept: */*' \
  -H 'Authorization: Bearer eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJodHRwOi8vc2NoZW1hcy54bWxzb2FwLm9yZy93cy8yMDA1LzA1L2lkZW50aXR5L2NsYWltcy
```

Request URL

```
https://localhost:7237/api/Admin/settings
```

Server response

Code	Details
200	Response body

```
{
  "message": "Settings accessible by Admin and User roles",
  "yourRole": "User"
}
```

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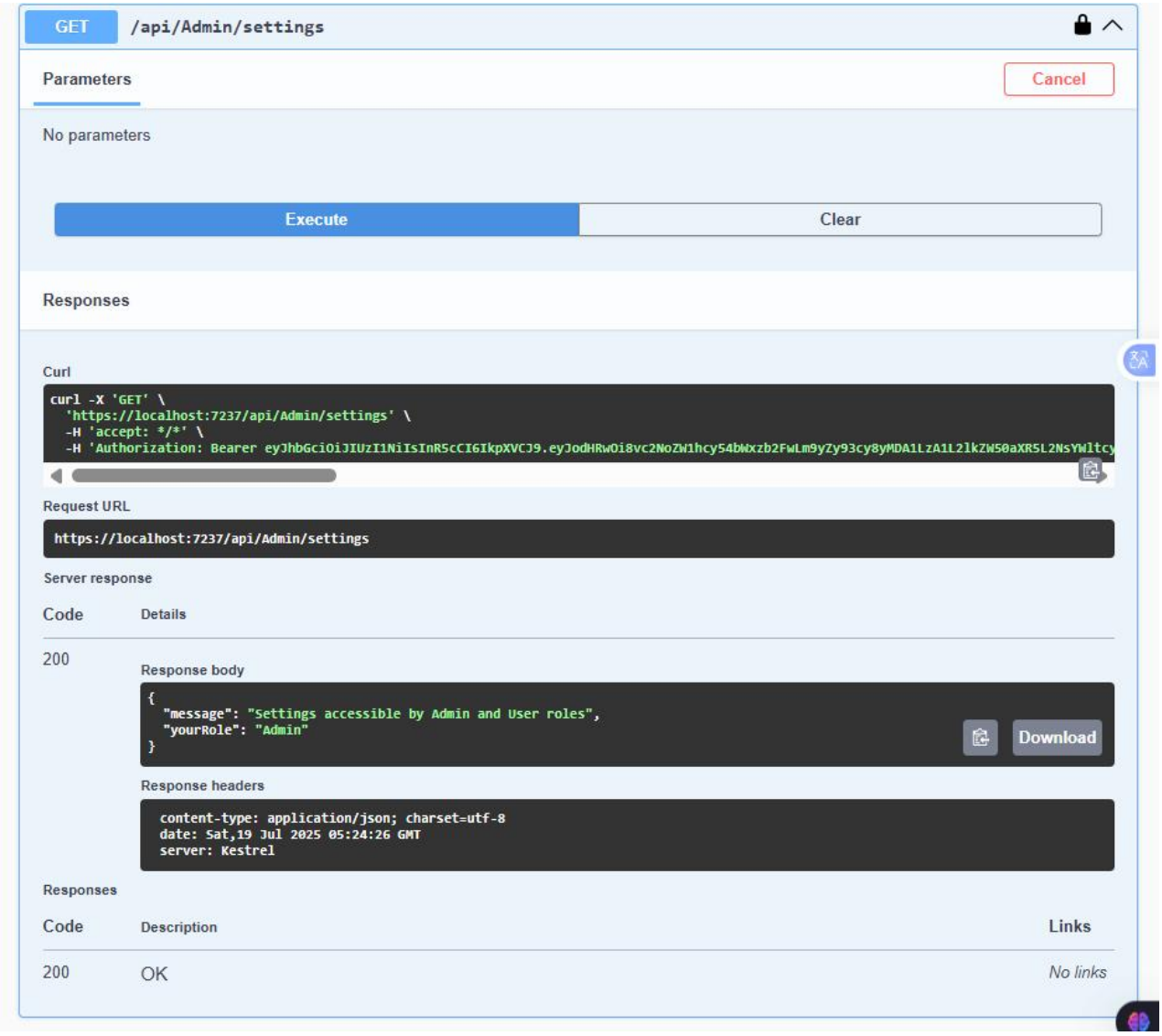
Response headers

```
content-type: application/json; charset=utf-8
date: Sat,19 Jul 2025 05:22:18 GMT
server: Kestrel
```

Responses

Code	Description	Links
200	OK	*No links*

- **Admin Role**



Part 5: Assignment 4 – Token Expiry Handling

Step 13: Enhanced Error Handling (Program.cs)

Updating JWT authentication code:

```
builder.Services.AddAuthentication(JwtBearerDefaults.AuthenticationScheme)
    .AddJwtBearer(options =>
    {
        options.TokenValidationParameters = new TokenValidationParameters
        {
            ValidateIssuer = true,
            ValidateAudience = true,
```

```
        ValidateLifetime = true,
        ValidateIssuerSigningKey = true,
        ValidIssuer = builder.Configuration["Jwt:Issuer"],
        ValidAudience = builder.Configuration["Jwt:Audience"],
        IssuerSigningKey = new SymmetricSecurityKey(
            Encoding.UTF8.GetBytes(builder.Configuration["Jwt:Key"]!)),
        ClockSkew = TimeSpan.Zero
    };

    options.Events = new JwtBearerEvents
    {
        OnAuthenticationFailed = context =>
        {
            if (context.Exception.GetType() == typeof(SecurityTokenExpiredException))
            {
                context.Response.Headers.Add("Token-Expired", "true");
            }
            return Task.CompletedTask;
        },
        OnChallenge = context =>
        {
            context.HandleResponse();
            context.Response.StatusCode = 401;
            context.Response.ContentType = "application/json";

            var result = System.Text.Json.JsonSerializer.Serialize(new
            {
                error = "Unauthorized",
                message = "You are not authorized to access this resource.",
                timestamp = DateTime.Now
            });

            return context.Response.WriteAsync(result);
        },
        OnForbidden = context =>
        {
            context.Response.StatusCode = 403;
            context.Response.ContentType = "application/json";

            var result = System.Text.Json.JsonSerializer.Serialize(new
            {
                error = "Forbidden",
                message = "You don't have permission to access this resource.",
                timestamp = DateTime.Now
            });
```

```
            return context.Response.WriteAsync(result);
        }
    };
});
```

Step 14: TestController for Token Expiry

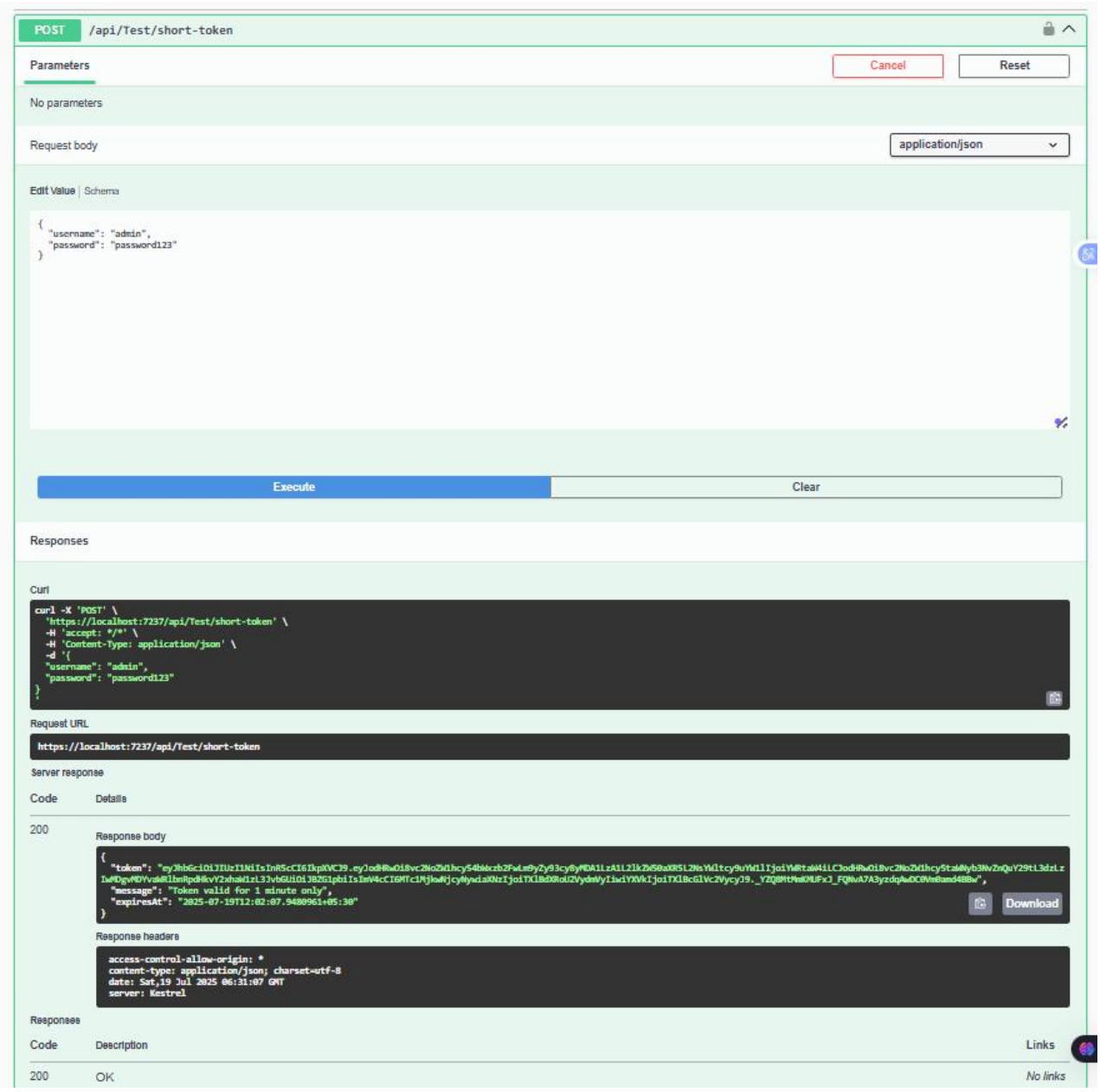
Adding `Controllers/TestController.cs`:

```
using Microsoft.AspNetCore.Authorization;
using Microsoft.AspNetCore.Mvc;
using Microsoft.IdentityModel.Tokens;
using System.IdentityModel.Tokens.Jwt;
using System.Security.Claims;
using System.Text;
using JwtMicroservice.Models;

namespace JwtMicroservice.Controllers
{
    [ApiController]
    [Route("api/[controller]")]
    public class TestController : ControllerBase
    {
        private readonly IConfiguration _configuration;

        public TestController(IConfiguration configuration)
        {
            _configuration = configuration;
        }

        [HttpPost("short-token")]
        public IActionResult GenerateShortToken([FromBody] LoginModel model)
        {
            if (model.Username == "admin" && model.Password == "password123")
            {
                var token = GenerateShortJwtToken(model.Username);
                return Ok(new {
                    Token = token,
                    Message = "Token valid for 1 minute only",
                    ExpiresAt = DateTime.Now.AddMinutes(1)
                });
            }
            return Unauthorized();
```

```
    }

    [HttpGet("protected")]
    [Authorize]
    public IActionResult GetProtectedData()
    {
        return Ok(new {
            Message = "Access granted!",
            User = User.FindFirst(ClaimTypes.Name)?.Value,
            Timestamp = DateTime.Now
        });
    }

    private string GenerateShortJwtToken(string username)
    {
        var claims = new[]
        {
            new Claim(ClaimTypes.Name, username),
            new Claim(ClaimTypes.Role, "Admin")
        };

        var key = new SymmetricSecurityKey(
            Encoding.UTF8.GetBytes(_configuration["Jwt:Key"]!));
        var creds = new SigningCredentials(key, SecurityAlgorithms.HmacSha256);

        var token = new JwtSecurityToken(
            issuer: _configuration["Jwt:Issuer"],
            audience: _configuration["Jwt:Audience"],
            claims: claims,
            expires: DateTime.Now.AddMinutes(1),
            signingCredentials: creds);

        return new JwtSecurityTokenHandler().WriteToken(token);
    }
  }
}
```

Step 16: Testing Expiry Handling

- Using POST /api/Test/short-token, getting the token, and letting it expire.



After Expiration:

- Using this expired token at /api/Test/protected: should receive a custom 401 response with a message and timestamp.

RESULT:

GET /api/Test/protected

Parameters

Cancel

No parameters

Execute Clear

Responses

Curl

```
curl -X 'GET' \
  'https://localhost:7237/api/Test/protected' \
  -H 'accept: */*' \
  -H 'Authorization: Bearer eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJodHRwOi8vc2NoZW1hcy54bWxzb2FwLm9yZy93cy8yMDA1LzA1L2lkZW50aXR5L
```

Request URL

```
https://localhost:7237/api/Test/protected
```

Server response

Code	Details
401 *Undocumented*	Error: response status is 401

Response body

```
{
  "error": "Unauthorized",
  "message": "You are not authorized to access this resource.",
  "timestamp": "2025-07-19T12:06:26.2165852+05:30"
}
```

Download

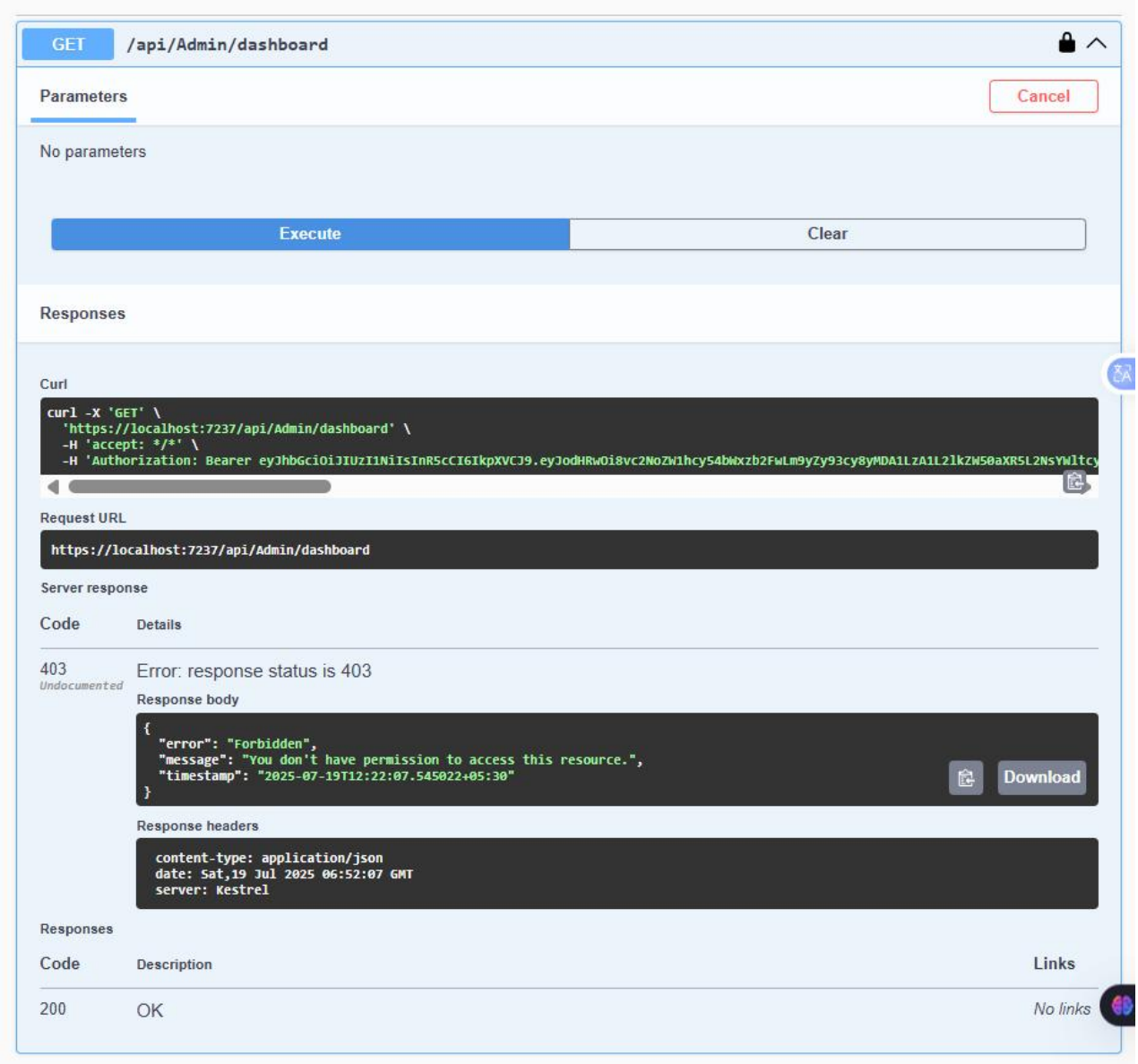
Response headers

```
content-type: application/json
date: Sat,19 Jul 2025 06:36:25 GMT
server: Kestrel
token-expired: true
```

Responses

Code	Description	Links
200	OK	*No links*

- Attempting forbidden role access as `user` at `GET /api/Admin/dashboard`: seeing a custom 403 message.



CONCLUSION:

Final Testing Scenarios

- **Public access:** `/api/Secure/public` – no token needed.
- **Login as admin:** `/api/Auth/login` – get token.
- **Access protected data:** `/api/Secure/data` – token required.
- **Admin dashboard:** `/api/Admin/dashboard` – admin token required.

- **Login as user:** `/api/Auth/login` – get user token.
- **Try admin dashboard as user:** should get 403 Forbidden.
- **Access settings:** `/api/Admin/settings` – both admin and user can access.
- **Token expiry test:** generate a short-lived token and test expiry handling.

This contains all four assignments: basic JWT, secure endpoints, role-based authorization, and token expiry handling.