INFORMATIKOS FAKULTETAS

T120B162 Programų sistemų testavimas

2 laboratorinis darbas

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Turinys

1. Įvadas

2 laboratorinio darbo tikslas – ištestuoti kuriamos sistemos komponentus, sukuriant komponentų vienetų (angl. Unit) testus.

Darbo uždaviniai:

1. Susirasti bei tinkamai panaudoti testavimo priemones sistemos komponentų testavimui;
2. Išsiaiškinti, kaip aprašomi bei sukuriami vienetų testai;
3. Sukurti vienetų testus visiems API metodams;
4. Vienetų testais padengti 100% API programos kodo.

2. Testavimo priemonės

Atsižvelgiant į kuriamos sistemos kūrimo priemones bei naudojamą karkasą, testų kūrimui pasirinkta naudotis tokias priemones:

1. Testų rašymo karkasas – xUnit (v2.3.1);
2. Programos objektų funkcionalumo imitavimas – Moq (v4.7.145);
3. Priemonė testų vykdymui – JetBrains ReSharper Ultimate 2017.2.2;
4. Įrankis, skirtas nustatyti programos kodo padengimą testais – JetBrains dotCover 2017.2.2;

3. Testuojamo API programos kodas

Žemiau pateikiamas programos kodas, kuris bus padengiamas komponentų testais. Iš viso testais bus padengiamos 5 API klasės:

1 lentelė. Testinio API kontrolerio programos kodas

TestController.cs

```
using Microsoft.AspNetCore.Mvc;

namespace ScatterifyAPI.Controllers
{
    public class TestController : Controller
    {
        [HttpGet]
        [Route("api/ping")]
        public IActionResult TestConnectionToApi()
        {
            return Ok("API is working!");
        }
    }
}
```

2 lentelė. Autentifikacijos API kontrolerio programos kodas

AuthController.cs

```
using System.Threading.Tasks;
using AutoMapper;
```

```
using Microsoft.AspNetCore.Authorization;
using Microsoft.AspNetCore.Mvc;
using ScatterifyAPI.Entities;
using ScatterifyAPI.Models;
using ScatterifyAPI.Services;

namespace ScatterifyAPI.Controllers
{
    [Authorize(Policy="FacebookAuthentication")]
    public class AuthController : Controller
    {
        private readonly IUsersRepository _usersRepository;
        private readonly IFacebookService _facebookService;

        public AuthController(IUsersRepository usersRepository,
IFacebookService facebookService)
        {
            _usersRepository = usersRepository;
            _facebookService = facebookService;
        }

        [HttpPost]
        [AllowAnonymous]
        [Route("auth/facebook")]
        public async Task<IActionResult> FacebookLogin([FromBody]
FacebookLoginRequestDto request)
        {
            var response = await _facebookService.FacebookLogin(request);
            if (response == null)
            {
                return BadRequest();
            }
            if (!_usersRepository.UserExists(response.userID))
            {
                var userForCreation = new UserForCreationDto
                {
                    Username = response.userID
                };

                var newUser = Mapper.Map<User>(userForCreation);
                _usersRepository.CreateUser(newUser);
                if (!_usersRepository.Save())
                {
                    return StatusCode(500, "A problem happened while handling
your request.");
                }
            }
            response.roleID =
_usersRepository.GetUser(response.userID).Role.Id;
            return Ok(Mapper.Map<FacebookLoginResponseDto>(response));
        }
    }
}
```

3 lentelė. Prekybos vietų API kontrolerio programos kodas

BranchesController.cs

`using Microsoft.AspNetCore.Authorization;`
`using Microsoft.AspNetCore.Mvc;`
`using ScatterifyAPI.Services;`

```
namespace ScatterifyAPI.Controllers
{
    [Authorize(Policy = "FacebookAuthentication")]
    [Route("api/branches")]
    public class BranchesController : Controller
    {
        private readonly IBranchesRepository _branchesRepository;
        private readonly IUsersRepository _usersRepository;

        public BranchesController(IBranchesRepository branchesRepository,
IUsersRepository usersRepository)
        {
            _branchesRepository = branchesRepository;
            _usersRepository = usersRepository;
        }
        [HttpGet]
        public IActionResult GetBranches()
        {
            var user =
_usersRepository.GetAuthenticatedUser(HttpContext.Request);
            if (user == null)
            {
                return BadRequest();
            }
            return Ok(_branchesRepository.GetBranches(user));
        }
    }
}
```

4 lentelė. Užsakymų API kontrolerio programos kodas

OrdersController.cs

```
using AutoMapper;
using Microsoft.AspNetCore.Authorization;
using Microsoft.AspNetCore.Mvc;
using ScatterifyAPI.Models;
using ScatterifyAPI.Services;
using System.Collections.Generic;
using System.Threading.Tasks;

namespace ScatterifyAPI.Controllers
{
    [Authorize(Policy = "FacebookAuthentication")]
    [Route("api")]
    public class OrdersController : Controller
    {
        private readonly IOrdersRepository _orderRepository;
        private readonly IBranchesRepository _branchesRepository;

        public OrdersController(IOrdersRepository orderRepository,
IBranchesRepository branchesRepository)
        {
            _orderRepository = orderRepository;
            _branchesRepository = branchesRepository;
        }
        [HttpGet("branches/{branchResourceID}/orders")]
        public async Task<IActionResult> GetOrdersAsync(string
branchResourceId)
        {
```

```
            if
(!_branchesRepository.BranchExistsAsync(branchResourceId).Result)
            {
                return NotFound();
            }

            var orderEntities = await
_orderRepository.GetOrdersAsync(branchResourceId);

            var result = Mapper.Map<ICollection<OrderDto>>(orderEntities);

            return Ok(result);
        }
        // TODO: change to patch
        [HttpPut("orders/{orderResourceID}")]
        public async Task<IActionResult> UpdateOrderStatusAsync(string
orderResourceId, [FromBody] OrderUpdateDto orderUpdateDto)
        {
            if (orderUpdateDto == null)
            {
                return BadRequest();
            }

            var orderEntity = await
_orderRepository.GetOrderAsync(orderResourceId);

            if (orderEntity == null)
            {
                return NotFound();
            }

            Mapper.Map(orderUpdateDto, orderEntity);

            if (!_orderRepository.Save())
            {
                return StatusCode(500, "A problem happened while handling
your request.");
            }

            return Ok(Mapper.Map<OrderDto>(orderEntity));
        }
    }
}
```

5 lentelė. Organizacijų API kontrolerio programos kodas

OrganizationsController.cs

```
using AutoMapper;
using Microsoft.AspNetCore.Authorization;
using Microsoft.AspNetCore.Mvc;
using ScatterifyAPI.Entities;
using ScatterifyAPI.Models;
using ScatterifyAPI.Services;
using System.Threading.Tasks;

namespace ScatterifyAPI.Controllers
{
    [Authorize(Policy = "FacebookAuthentication")]
    [Route("api/organizations")]
    public class OrganizationsController : Controller
```

```
    {
        private readonly IOrganizationsRepository _organizationsRepository;
        private readonly IUsersRepository _usersRepository;
        private readonly IBranchUsersRepository _branchUsersRepository;

        public OrganizationsController(IOrganizationsRepository
organizationsRepository, IUsersRepository usersRepository,
IBranchUsersRepository branchUsersRepository)
        {
            _organizationsRepository = organizationsRepository;
            _usersRepository = usersRepository;
            _branchUsersRepository = branchUsersRepository;
        }
        [HttpGet]
        public async Task<IActionResult> GetOrganizationWithBranchesAsync()
        {
            var user =
_usersRepository.GetAuthenticatedUser(HttpContext.Request);
            if (user == null)
            {
                return BadRequest();
            }
            return Ok(await
_organizationsRepository.GetOrganizationWithBranches(user));
        }
        [HttpPost]
        public async Task<IActionResult>
CreateNewOrganizationAsync([FromBody] OrganizationForCreationDto
organization)
        {
            var user =
_usersRepository.GetAuthenticatedUser(HttpContext.Request);
            if (user == null)
            {
                return BadRequest();
            }
            if (organization == null)
            {
                return BadRequest();
            }
            var newBranch = Mapper.Map<Branch>(organization);
            _organizationsRepository.CreateOrganization(newBranch);
            if (!_organizationsRepository.Save())
            {
                return StatusCode(500, "A problem happened while handling
your request.");
            }
            var newBranchUser = Mapper.Map<BranchUser>(new
BranchUserForCreationDto
            {
                BranchId = newBranch.Id,
                UserId = user.Id
            });
            _branchUsersRepository.CreateBranchUser(newBranchUser);
            if (!_branchUsersRepository.Save())
            {
                return StatusCode(500, "A problem happened while handling
your request.");
            }
            return Ok(await
_organizationsRepository.GetOrganizationWithBranches(user));
        }
```

```
        [HttpPut("{organizationResourceID}")]
        public async Task<IActionResult> UpdateOrganizationAsync([FromBody]
OrganizationForCreationDto organization, string organizationResourceId)
        {
            var user =
_usersRepository.GetAuthenticatedUser(HttpContext.Request);
            if(user == null)
            {
                return BadRequest();
            }
            if (organization == null)
            {
                return BadRequest();
            }
            var organizationEntity = await
_organizationsRepository.GetOrganization(organizationResourceId);
            if (organizationEntity == null)
            {
                return NotFound();
            }
            Mapper.Map(organization, organizationEntity);
            if (!_organizationsRepository.Save())
            {
                return StatusCode(500, "A problem happened while handling
your request.");
            }
            return Ok(await
_organizationsRepository.GetOrganizationWithBranches(user));
        }
    }
}
```

4. Pasiruošimas testavimui

Prieš aprašant API komponentų testus, reikia tinkamai paruošti testavimo failų struktūrą, bei sukurti reikiamus elementus. Pirmiausia sukuriamos komponentų testų klasės (kiekvienai API klasei po atskirą testavimo klasę):

6 lentelė. Testinio API kontrolerio testavimo klasė

TestControllerUnitTests.cs

`namespace ScatterifyAPI.Tests.UnitTests`
`{`
`  public class TestControllerUnitTests`
`  {`
 	
`  }`
`}`

7 lentelė. Autentifikacijos API kontrolerio testavimo klasė

AuthControllerUnitTests.cs

`using System;`
`using Moq;`
`using ScatterifyAPI.Services;`

```
using Xunit;

namespace ScatterifyAPI.Tests.UnitTests
{
    [Collection("Mapper collection")]
    public class AuthControllerUnitTests : IDisposable
    {
        private readonly Mock<IUsersRepository> _usersRepository;
        private readonly Mock<IFacebookService> _facebookServiceMock;

        public AuthControllerUnitTests()
        {
            _usersRepository = new Mock<IUsersRepository>();
            _facebookServiceMock = new Mock<IFacebookService>();
        }

        public void Dispose()
        {
            _usersRepository.Reset();
            _facebookServiceMock.Reset();
        }
    }
}
```

8 lentelė. Organizacijų API kontrolerio testavimo klasė

OrganizationsControllerUnitTests.cs

```
using Microsoft.AspNetCore.Http;
using Moq;
using ScatterifyAPI.Services;
using System;
using Xunit;

namespace ScatterifyAPI.Tests.UnitTests
{
    [Collection("Mapper collection")]
    public class OrganizationsControllerUnitTests : IDisposable
    {
        private readonly Mock<HttpContext> _context;
        private readonly Mock<HttpRequest> _request;
        private readonly Mock<IOrganizationsRepository> _organizationsRepository;
        private readonly Mock<IUsersRepository> _usersRepository;
        private readonly Mock<IBranchUsersRepository> _branchUsersRepository;

        public OrganizationsControllerUnitTests()
        {
            _context = new Mock<HttpContext>();
            _request = new Mock<HttpRequest>();
            _organizationsRepository = new Mock<IOrganizationsRepository>();
            _usersRepository = new Mock<IUsersRepository>();
            _branchUsersRepository = new Mock<IBranchUsersRepository>();
        }

        public void Dispose()
        {
            _context.Reset();
            _request.Reset();
            _organizationsRepository.Reset();
            _usersRepository.Reset();
            _branchUsersRepository.Reset();
```

```
        }
    }
}
```

9 lentelė. Užsakymų API kontrolerio testavimo klasė

OrdersControllerUnitTests.cs

```
using System;
using Moq;
using ScatterifyAPI.Services;
using Xunit;

namespace ScatterifyAPI.Tests.UnitTests
{
    [Collection("Mapper collection")]
    public class OrdersControllerUnitTests : IDisposable
    {
        private readonly Mock<IOrdersRepository> _ordersRepository;
        private readonly Mock<IBranchesRepository> _branchesRepository;

        public OrdersControllerUnitTests()
        {
            _ordersRepository = new Mock<IOrdersRepository>();
            _branchesRepository = new Mock<IBranchesRepository>();
        }

        public void Dispose()
        {
            _ordersRepository.Reset();
            _branchesRepository.Reset();
        }
    }
}
```

10 lentelė. Prekybos vietų API kontrolerio testavimo klasė

BranchesControllerUnitTests.cs

```
using Microsoft.AspNetCore.Http;
using Moq;
using ScatterifyAPI.Services;
using System;

namespace ScatterifyAPI.Tests.UnitTests
{
    public class BranchesControllerUnitTests : IDisposable
    {
        private readonly Mock<HttpContext> _context;
        private readonly Mock<HttpRequest> _request;
        private readonly Mock<IUsersRepository> _usersRepository;
        private readonly Mock<IBranchesRepository> _branchesRepository;
        public BranchesControllerUnitTests()
        {
            _context = new Mock<HttpContext>();
            _request = new Mock<HttpRequest>();
            _usersRepository = new Mock<IUsersRepository>();
            _branchesRepository = new Mock<IBranchesRepository>();
        }
```

```
        public void Dispose()
        {
            _context.Reset();
            _request.Reset();
            _usersRepository.Reset();
            _branchesRepository.Reset();
        }
    }
}
```

Taip pat sukurta papildoma klasė MapperFixture, kuri reikalinga duomenų objektų surišimo sukūrimui prieš vykdant visus testus.

11 lentelė. Duomenų objektų surišimo sukūrimo klasė

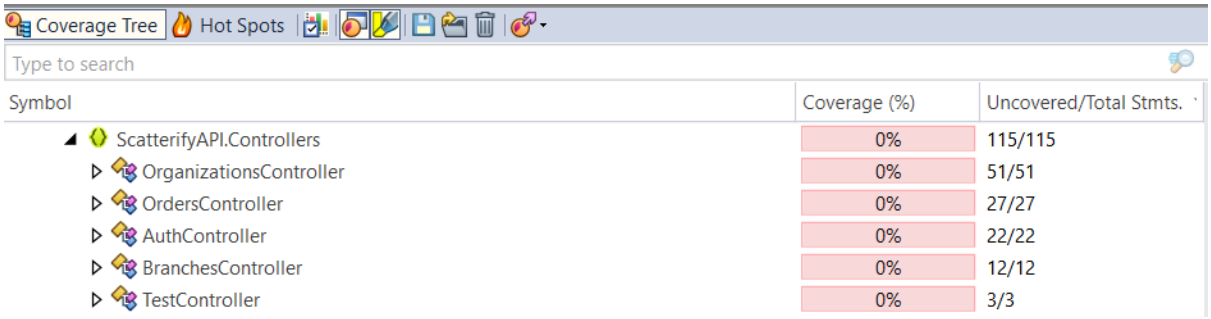
MapperFixture.cs

```
using System;
using System.Collections.Generic;
using System.Linq;
using AutoMapper;
using ScatterifyAPI.Entities;
using ScatterifyAPI.Models;
using Xunit;

namespace ScatterifyAPI.Tests.Fixtures
{
    public class MapperFixture : IDisposable
    {
        public MapperFixture()
        {
            Mapper.Initialize(cfg => {
                cfg.CreateMap<Order, OrderDto>()
                    .ForMember(dest => dest.branchResourceID, opt => opt.MapFrom(src
=> src.OrderProducts.Select(op => op.Product.ResourceId).FirstOrDefault()))
                    .ForMember(dest => dest.orderResourceID, opt => opt.MapFrom(src
=> src.ResourceId))
                    .ForMember(dest => dest.orderStatusID, opt => opt.MapFrom(src =>
src.Status))
                    .ForMember(dest => dest.orderCreatedAt, opt => opt.Equals(0))
                    .ForMember(dest => dest.clientUsername, opt => opt.MapFrom(src
=> src.Client.Username))
                    .ForMember(dest => dest.clientFullName, opt => opt.MapFrom(src
=> src.Client.FullName))
                    .ForMember(dest => dest.clientPhotoUrl, opt => opt.MapFrom(src
=> src.Client.PhotoUrl))
                    .ForMember(dest => dest.orderItems, opt => opt.MapFrom(src =>
Mapper.Map<ICollection<OrderItemDto>>(src.OrderProducts)));
                cfg.CreateMap<OrderProduct, OrderItemDto>()
                    .ForMember(dest => dest.productTitle, opt => opt.MapFrom(src =>
src.Product.Title))
                    .ForMember(dest => dest.productPrice, opt => opt.MapFrom(src =>
src.Product.Price))
                    .ForMember(dest => dest.categoriesTree, opt => opt.MapFrom(src
=> string.Join(',', src.InverseOrderProductParent.Select(iop =>
iop.Product.Title).ToList())));
                cfg.CreateMap<UserForCreationDto, User>();
                cfg.CreateMap<Branch, BranchDto>();
```

```
                cfg.CreateMap<UserDto, FacebookLoginResponseDto>();
                cfg.CreateMap<OrderUpdateDto, Order>();
                cfg.CreateMap<OrganizationForCreationDto, Branch>();
                cfg.CreateMap<BranchUserForCreationDto, BranchUser>();
            });
        }
        public void Dispose()
        {
            Mapper.Reset();
        }
    }

    [CollectionDefinition("Mapper collection")]
    public class MapperCollection : ICollectionFixture<MapperFixture> { }
}
```

5. API programos kodo padengimas testais prieš testų sukūrimą

Prieš sukuriant komponentų testus, dotCover įrankiu buvo patikrintas pirminis API programos kodo padengimas. Kaip ir buvo tikėtasi, įrankis parodo, kad komponentų testais yra padengta 0% kodo (1 pav.).



1 pav. API programos kodo padengimas prieš sukuriant testus

Taip pat prie atitinkamo programos kodo (API metodų kodo eilučių) dotCover įrankis rodo, kad eilutės yra nepadengtos jokiais testais – prie atitinkamų eilučių yra rodomas pilkas laukelis (2 pav.).

```
18        public OrdersController(IOrdersRepository orderRepository, IBranchesRepository branchesRepository)
19        {
20            _orderRepository = orderRepository;
21            _branchesRepository = branchesRepository;
22        }
23        [HttpGet("branches/{branchResourceID}/orders")]
          0 references | mangirdaskazlauskas, 16 hours ago | 1 author, 2 changes | 1 request | 0 exceptions
24        public async Task<IActionResult> GetOrdersAsync(string branchResourceId)
25        {
26            if (!_branchesRepository.BranchExistsAsync(branchResourceId).Result)
27            {
28  Statement uncovered urn NotFound();
29            }
30
31            var orderEntities = await _orderRepository.GetOrdersAsync(branchResourceId);
32
33            var result = Mapper.Map<ICollection<OrderDto>>(orderEntities);
34
35            return Ok(result);
36        }
```

2 pav. Užsakymo kontrolerio kodo eilutės nėra nepadengtos testais

6. Testavimo atvejai ir jų kodas

Šiame skyriuje pateikiami aprašyti komponentų testai. Kiekvienas testas yra pateikiamas lentele, kurią sudaro 3 dalys: 1-oji nurodo komponento testo pavadinimą, antroji – ką testuoja atitinkamas testas, o trečioje lentelės dalyje pateikiamas testo kodas. Iš viso buvo parašyti 33 komponentų testai.

1. **TestController** komponentų testai:

Should_Return_Ok_Result_When_Testing_Connection_To_Api
Testuojama, ar galima siųsti užklausą į API.
`[Fact]`

```
[Fact]
        public void Should_Return_Ok_Result_When_Testing_Connection_To_Api()
        {
            // Arrange
            var controller = new TestController();

            // Act
            var result = controller.TestConnectionToApi();

            // Assert
            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;
            okResult.StatusCode.Should().Be(200);
            okResult.Value.Should().Be("API is working!");
        }
```

2. **AuthController** komponentų testai:

Should_Not_be_Null_With_Valid_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su teisingais parametrais.
`[Fact]`

```
[Fact]
        public void Should_Not_be_Null_With_Valid_Parameters()
        {
```

```
            // Arrange

            // Act
            var controller = new AuthController(_usersRepository.Object,
_facebookServiceMock.Object);

            // Assert
            var authController =
controller.Should().BeOfType<AuthController>().Subject;
            authController.Should().NotBeNull();
        }
```

Should_Not_Be_Null_With_Null_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su tuščiais parametrais.

```
[Fact]
        public void Should_Not_Be_Null_With_Null_Parameters()
        {
            // Arrange

            // Act
            var controller = new AuthController(null, null);

            // Assert
            var authController =
controller.Should().BeOfType<AuthController>().Subject;
            authController.Should().NotBeNull();
        }
```

Should_Return_Bad_Request_When_Facebook_Login_Request_Is_Null_On_Facebook_Login
Testuojamas Facebook prisijungimo metodas, kai siunčiamas užklausos objektas yra netinkamas.

```
[Fact]
        public async Task
Should_Return_Bad_Request_When_Facebook_Login_Request_Is_Null_On_Facebook_Login()
        {
            // Arrange
            _facebookServiceMock.Setup(mockService =>
mockService.FacebookLogin(It.IsAny<FacebookLoginRequestDto>())).ReturnsAsync(() =>
null);

            var controller = new AuthController(_usersRepository.Object,
_facebookServiceMock.Object);

            // Act
            var result = await controller.FacebookLogin(new
FacebookLoginRequestDto());

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;
            badRequestResult.StatusCode.Should().Be(400);
        }
```

Should_Return_Internal_Server_Error_When_New_User_Is_Not_Saved_On_Facebook_Login
Testuojamas Facebook prisijungimo metodas, kai naujas sistemos naudotojas nėra išsaugomas pirmo prisijungimo prie sistemos metu.

```
[Fact]
        public async Task
Should_Return_Internal_Server_Error_When_New_User_Is_Not_Saved_On_Facebook_Login()
        {
            // Arrange
            _facebookServiceMock.Setup(mockService =>
mockService.FacebookLogin(It.IsAny<FacebookLoginRequestDto>())).ReturnsAsync(() =>
new UserDto());

            _usersRepository.Setup(mockRep =>
mockRep.UserExists(It.IsAny<string>())).Returns(false);
            _usersRepository.Setup(mockRep => mockRep.Save()).Returns(false);

            var controller = new AuthController(_usersRepository.Object,
_facebookServiceMock.Object);

            // Act
            var result = await controller.FacebookLogin(new
FacebookLoginRequestDto());

            // Assert
            var internalServerErrorResult =
result.Should().BeOfType<ObjectResult>().Subject;

            internalServerErrorResult.StatusCode.Should().Be(500);
            internalServerErrorResult.Value.Should().Be("A problem happened while
handling your request.");
        }
```

Should_Return_Facebook_Login_Response_When_New_User_Is_Saved_Successfully_On_Facebook_Login
Testuojamas Facebook prisijungimo metodas, kai naujas sistemos naudotojas yra išsaugomas pirmo prisijungimo prie sistemos metu.

```
[Fact]
        public async Task
Should_Return_Facebook_Login_Response_When_New_User_Is_Saved_Successfully_On_Facebook_Login()
        {
            // Arrange
            _facebookServiceMock.Setup(mockService =>
mockService.FacebookLogin(It.IsAny<FacebookLoginRequestDto>())).ReturnsAsync(() =>
new UserDto());

            _usersRepository.Setup(mockRep =>
mockRep.UserExists(It.IsAny<string>())).Returns(false);
            _usersRepository.Setup(mockRep => mockRep.Save()).Returns(true);
            _usersRepository.Setup(mockRep =>
mockRep.GetUser(It.IsAny<string>())).Returns(() => new User
            {
                Role = new Role
                {
                    Id = 1
```

```
                }
            });

            var controller = new AuthController(_usersRepository.Object,
_facebookServiceMock.Object);

            // Act
            var result = await controller.FacebookLogin(new
FacebookLoginRequestDto());

            // Assert
            // Verify that Save and CreateUser methods were called once in
usersRepository
            _usersRepository.Verify(mockRep => mockRep.CreateUser(It.IsAny<User>()),
Times.Once);
            _usersRepository.Verify(mockRep => mockRep.Save(), Times.Once);

            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;

            okResult.StatusCode.Should().Be(200);
            okResult.Value.Should().BeAssignableTo<FacebookLoginResponseDto>();
        }
```

Should_Return_Facebook_Login_Response_When_User_Exists_On_Facebook_Login
Testuojamas Facebook prisijungimo metodas, kai sistemos naudotojas prie sistemos jungiasi ne pirmą kartą – jau egzistuoja.

```
[Fact]
        public async Task
Should_Return_Facebook_Login_Response_When_User_Exists_On_Facebook_Login()
        {
            // Arrange
            _facebookServiceMock.Setup(mockService =>
mockService.FacebookLogin(It.IsAny<FacebookLoginRequestDto>())).ReturnsAsync(() =>
new UserDto());

            _usersRepository.Setup(mockRep =>
mockRep.UserExists(It.IsAny<string>())).Returns(true);
            _usersRepository.Setup(mockRep => mockRep.Save()).Returns(true);
            _usersRepository.Setup(mockRep =>
mockRep.GetUser(It.IsAny<string>())).Returns(() => new User
            {
                Role = new Role
                {
                    Id = 1
                }
            });

            var controller = new AuthController(_usersRepository.Object,
_facebookServiceMock.Object);

            // Act
            var result = await controller.FacebookLogin(new
FacebookLoginRequestDto());

            // Assert
            // Verify that Save and CreateUser methods were not called in
usersRepository
```

```
            _usersRepository.Verify(mockRep => mockRep.CreateUser(It.IsAny<User>()),
Times.Never);
            _usersRepository.Verify(mockRep => mockRep.Save(), Times.Never);

            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;

            okResult.StatusCode.Should().Be(200);
            okResult.Value.Should().BeAssignableTo<FacebookLoginResponseDto>();
        }
```

3. **OrganizationsController** komponentų testai:

Should_Not_be_Null_With_Valid_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su teisingais parametrais.

```
[Fact]
        public void Should_Not_Be_Null_With_Valid_Parameters()
        {
            // Arrange

            // Act
            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object);

            // Assert
            var organizationsController =
controller.Should().BeOfType<OrganizationsController>().Subject;
            organizationsController.Should().NotBeNull();
        }
```

Should_Not_Be_Null_With_Null_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su tuščiais parametrais.

```
[Fact]
        public void Should_Not_Be_Null_With_Null_Parameters()
        {
            // Arrange

            // Act
            var controller = new OrganizationsController(null, null, null);

            // Assert
            var organizationsController =
controller.Should().BeOfType<OrganizationsController>().Subject;
            organizationsController.Should().NotBeNull();
        }
```

Should_Return_Bad_Request_When_User_Is_Null
Testuojamas GetOrganizationWithBranchesAsync() metodas, kai autentifikuotas naudotojas nėra randamas.

```
[Fact]
```

```
        public async Task Should_Return_Bad_Request_When_User_Is_Null()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => null);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.GetOrganizationWithBranchesAsync();

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;

            badRequestResult.StatusCode.Should().Be(400);
        }
```

Should_Return_Organizations_With_Branches_List_When_User_Exists
Testuojamas GetOrganizationWithBranchesAsync() metodas, kai autentifikuotas naudotojas yra randamas.

```
[Fact]
        public async Task
Should_Return_Organizations_With_Branches_List_When_User_Exists()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _organizationsRepository.Setup(mockRep =>
mockRep.GetOrganizationWithBranches(It.IsAny<User>())).ReturnsAsync(new
List<OrganizationDto>
            {
                new OrganizationDto { organizationResourceID = "1"},
                new OrganizationDto { organizationResourceID = "2"},
                new OrganizationDto { organizationResourceID = "3"}
            });

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
```

```
            };

            // Act
            var result = await controller.GetOrganizationWithBranchesAsync();

            // Assert
            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;
            okResult.StatusCode.Should().Be(200);

            var organizations =
okResult.Value.Should().BeAssignableTo<IEnumerable<OrganizationDto>>().Subject;

            organizations.Count().Should().Be(3);
        }
```

Should_Return_Bad_Request_When_User_Is_Null_On_Organization_Create
Testuojamas organizacijos sukūrimo metodas, kai autentifikuotas naudotojas nėra randamas.

```
[Fact]
        public async Task
Should_Return_Bad_Request_When_User_Is_Null_On_Organization_Create()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => null);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.CreateNewOrganizationAsync(new
OrganizationForCreationDto());

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;

            badRequestResult.StatusCode.Should().Be(400);
        }
```

Should_Return_Bad_Request_When_Request_Body_Is_Null_On_Organization_Create
Testuojamas organizacijos sukūrimo metodas, kai užklausos duomenys nėra teisingi.

```
[Fact]
        public async Task
Should_Return_Bad_Request_When_Request_Body_Is_Null_On_Organization_Create()
        {
            // Arrange
```

```
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.CreateNewOrganizationAsync(null);

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;

            badRequestResult.StatusCode.Should().Be(400);
        }
```

Should_Return_Internal_Server_Error_When_Organization_Is_Not_Saved_On_Organization_Create
Testuojamas organizacijos sukūrimo metodas, kai organizacija nėra išsaugoma.

```
[Fact]
        public async Task
Should_Return_Internal_Server_Error_When_Organization_Is_Not_Saved_On_Organization_C
reate()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _organizationsRepository.Setup(mockRep =>
mockRep.CreateOrganization(It.IsAny<Branch>()));

            _organizationsRepository.Setup(mockRep =>
mockRep.Save()).Returns(false);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.CreateNewOrganizationAsync(new
OrganizationForCreationDto());
```

```
            // Assert
            var internalServerError =
result.Should().BeOfType<ObjectResult>().Subject;

            internalServerError.StatusCode.Should().Be(500);
            internalServerError.Value.Should().Be("A problem happened while handling
your request.");
        }
```

Should_Return_Internal_Server_Error_When_Branch_User_Is_Not_Saved_On_Organization_Create
Testuojamas organizacijos sukūrimo metodas, kai organizacijos vadybininkas nėra išsaugomas.

```
[Fact]
        public async Task
Should_Return_Internal_Server_Error_When_Branch_User_Is_Not_Saved_On_Organization_Cr
eate()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _organizationsRepository.Setup(mockRep =>
mockRep.CreateOrganization(It.IsAny<Branch>()));

            _organizationsRepository.Setup(mockRep => mockRep.Save()).Returns(true);

            _branchUsersRepository.Setup(mockRep =>
mockRep.CreateBranchUser(It.IsAny<BranchUser>()));

            _branchUsersRepository.Setup(mockRep => mockRep.Save()).Returns(false);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.CreateNewOrganizationAsync(new
OrganizationForCreationDto());

            // Assert
            var internalServerError =
result.Should().BeOfType<ObjectResult>().Subject;

            internalServerError.StatusCode.Should().Be(500);
            internalServerError.Value.Should().Be("A problem happened while handling
your request.");
        }
```

Should_Return_Organizations_With_Branches_List_On_Successful_Organization_Create
Testuojamas organizacijos sukūrimo metodas, kai organizacija yra sėkmingai išsaugoma.

```
[Fact]
        public async Task
Should_Return_Organizations_With_Branches_List_On_Successful_Organization_Create()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _organizationsRepository.Setup(mockRep =>
mockRep.CreateOrganization(It.IsAny<Branch>()));

            _organizationsRepository.Setup(mockRep => mockRep.Save()).Returns(true);

            _organizationsRepository.Setup(mockRep =>
mockRep.GetOrganizationWithBranches(It.IsAny<User>())).ReturnsAsync(new
List<OrganizationDto>
            {
                new OrganizationDto { organizationResourceID = "1"},
                new OrganizationDto { organizationResourceID = "2"},
                new OrganizationDto { organizationResourceID = "3"}
            });

            _branchUsersRepository.Setup(mockRep =>
mockRep.CreateBranchUser(It.IsAny<BranchUser>()));

            _branchUsersRepository.Setup(mockRep => mockRep.Save()).Returns(true);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.CreateNewOrganizationAsync(new
OrganizationForCreationDto());

            // Assert
            // Verify that CreateOrganization and Save methods were called once in
organizationsRepository
            _organizationsRepository.Verify(mockRep =>
mockRep.CreateOrganization(It.IsAny<Branch>()), Times.Once);
            _organizationsRepository.Verify(mockRep => mockRep.Save(), Times.Once);

            // Verify that CreateBranchUser and Save methods were called once in
branchUsersRepository
            _branchUsersRepository.Verify(mockRep =>
mockRep.CreateBranchUser(It.IsAny<BranchUser>()), Times.Once);
            _branchUsersRepository.Verify(mockRep => mockRep.Save(), Times.Once);

            // Result
            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;
            okResult.StatusCode.Should().Be(200);
```

```
            var organizations =
okResult.Value.Should().BeAssignableTo<IEnumerable<OrganizationDto>>().Subject;
            organizations.Should().NotBeNull();
            organizations.Count().Should().Be(3);
        }
```

Should_Return_Bad_Request_When_User_Is_Null_On_Organization_Update
Testuojamas organizacijos duomenų pakeitimo metodas, kai autentifikuotas naudotojas nėra randamas.

```
[Fact]
        public async Task
Should_Return_Bad_Request_When_User_Is_Null_On_Organization_Update()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => null);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.UpdateOrganizationAsync(new
OrganizationForCreationDto(), null);

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;

            badRequestResult.StatusCode.Should().Be(400);
        }
```

Should_Return_Bad_Request_When_Organization_Is_Null_On_Organization_Update
Testuojamas organizacijos duomenų pakeitimo metodas, kai užklausos duomenys nėra teisingi.

```
[Fact]
        public async Task
Should_Return_Bad_Request_When_Organization_Is_Null_On_Organization_Update()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());
```

```
            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.UpdateOrganizationAsync(null, null);

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;

            badRequestResult.StatusCode.Should().Be(400);
        }
```

Should_Return_Internal_Server_Error_When_Organization_Changes_Are_Not_Saved_On_Organization_Update
Testuojamas organizacijos duomenų pakeitimo metodas, kai organizacija nėra išsaugoma.

```
[Fact]
        public async Task
Should_Return_Internal_Server_Error_When_Organization_Changes_Are_Not_Saved_On_Organ
ization_Update()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _organizationsRepository.Setup(mockRep =>
mockRep.GetOrganization(It.IsAny<string>())).ReturnsAsync(() => new Branch
            {
                ResourceId = "1",
                Title = "New Branch"
            });

            _organizationsRepository.Setup(mockRep =>
mockRep.Save()).Returns(false);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.UpdateOrganizationAsync(new
OrganizationForCreationDto(), "1");
```

```
            // Assert
            var internalServerError =
result.Should().BeOfType<ObjectResult>().Subject;

            internalServerError.StatusCode.Should().Be(500);
            internalServerError.Value.Should().Be("A problem happened while handling
your request.");
        }
```

Should_Return_Not_Found_When_Organization_With_Provided_ID_Does_Not_Exist_On_Organization_Update
Testuojamas organizacijos duomenų pakeitimo metodas, kai organizacija, kurios duomenis norima pakeisti, nėra randama.

```
   [Fact]
        public async Task
Should_Return_Not_Found_When_Organization_With_Provided_ID_Does_Not_Exist_On_Organiz
ation_Update()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _organizationsRepository.Setup(mockRep =>
mockRep.GetOrganization(It.IsAny<string>())).ReturnsAsync(() => null);

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.UpdateOrganizationAsync(new
OrganizationForCreationDto(), "1");

            // Assert
            var notFoundResult = result.Should().BeOfType<NotFoundResult>().Subject;

            notFoundResult.StatusCode.Should().Be(404);
        }
```

Should_Return_Organization_With_Branches_List_On_Successful_Organization_Update
Testuojamas organizacijos duomenų pakeitimo metodas, kai organizacijos duomenys yra sėkmingai pakeičiami.

```
[Fact]
        public async Task
Should_Return_Organization_With_Branches_List_On_Successful_Organization_Update()
```

```
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(new Mock<HttpRequest>().Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _organizationsRepository.Setup(mockRep =>
mockRep.GetOrganization(It.IsAny<string>())).ReturnsAsync(() => new Branch
            {
                ResourceId = "1",
                Title = "New Branch"
            });

            _organizationsRepository.Setup(mockRep => mockRep.Save()).Returns(true);

            _organizationsRepository.Setup(mockRep =>
mockRep.GetOrganizationWithBranches(It.IsAny<User>())).ReturnsAsync(new
List<OrganizationDto>
            {
                new OrganizationDto { organizationResourceID = "1"},
                new OrganizationDto { organizationResourceID = "2"},
                new OrganizationDto { organizationResourceID = "3"}
            });

            var controller = new
OrganizationsController(_organizationsRepository.Object, _usersRepository.Object,
_branchUsersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = await controller.UpdateOrganizationAsync(new
OrganizationForCreationDto() {
                Title = "Updated Branch"
            }, "1");

            // Assert
            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;
            okResult.StatusCode.Should().Be(200);

            var organizations =
okResult.Value.Should().BeAssignableTo<IEnumerable<OrganizationDto>>().Subject;
            organizations.Should().NotBeNull();
            organizations.Count().Should().Be(3);
        }
```

4. **OrdersController** komponentų testai:

Should_Not_be_Null_With_Valid_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su teisingais parametrais.

`[Fact]`
`public void Should_Not_be_Null_With_Valid_Parameters()`
`{`

```
            // Arrange

            // Act
            var controller = new OrdersController(_ordersRepository.Object,
_branchesRepository.Object);

            // Assert
            var ordersController =
controller.Should().BeOfType<OrdersController>().Subject;
            ordersController.Should().NotBeNull();
        }
```

Should_Not_Be_Null_With_Null_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su tuščiais parametrais.

```
[Fact]
        public void Should_Not_Be_Null_With_Null_Parameters()
        {
            // Arrange

            // Act
            var controller = new OrdersController(null, null);

            // Assert
            var ordersController =
controller.Should().BeOfType<OrdersController>().Subject;
            ordersController.Should().NotBeNull();
        }
```

Should_Return_Not_Found_When_Branch_Does_Not_Exist_On_Get_Orders
Testuojamas GetOrdersAsync() metodas, kai norimų gražinti užsakymų pardavimo vieta neegzistuoja.

```
[Fact]
        public async Task
Should_Return_Not_Found_When_Branch_Does_Not_Exist_On_Get_Orders()
        {
            // Arrange
            _branchesRepository.Setup(mockRep =>
mockRep.BranchExistsAsync(It.IsAny<string>())).ReturnsAsync(false);

            var controller = new OrdersController(_ordersRepository.Object,
_branchesRepository.Object);

            // Act
            var result = await controller.GetOrdersAsync(It.IsAny<string>());

            // Assert
            var notFoundResult = result.Should().BeOfType<NotFoundResult>().Subject;
            notFoundResult.StatusCode.Should().Be(404);
        }
```

Should_Return_Orders_List_On_Get_Orders

Testuojamas GetOrdersAsync() metodas, kai grąžinami visi pardavimo vietai priskirti užsakymai.

```
[Fact]
        public async Task Should_Return_Orders_List_On_Get_Orders()
        {
            // Arrange
            _branchesRepository.Setup(mockRep =>
mockRep.BranchExistsAsync(It.IsAny<string>())).ReturnsAsync(true);

            _ordersRepository.Setup(mockRep =>
mockRep.GetOrdersAsync(It.IsAny<string>())).ReturnsAsync(new List<Order>
            {
                new Order{ResourceId = "1"},
                new Order{ResourceId = "2"},
                new Order{ResourceId = "3"}
            });

            var controller = new OrdersController(_ordersRepository.Object,
_branchesRepository.Object);

            // Act
            var result = await controller.GetOrdersAsync(It.IsAny<string>());

            // Assert
            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;
            okResult.StatusCode.Should().Be(200);

            var orders =
okResult.Value.Should().BeAssignableTo<ICollection<OrderDto>>().Subject;
            orders.Should().NotBeNull();
            orders.Count().Should().Be(3);
        }
```

Should_Return_Bad_Request_When_Request_Body_Is_Null_On_Order_Status_Update
Testuojamas užsakymo statuso pakeitimo metodas, kai užklausos duomenys yra neteisingi.

```
[Fact]
        public async Task
Should_Return_Bad_Request_When_Request_Body_Is_Null_On_Order_Status_Update()
        {
            // Arrange
            var controller = new OrdersController(_ordersRepository.Object,
_branchesRepository.Object);

            // Act
            var result = await controller.UpdateOrderStatusAsync(It.IsAny<string>(),
null);

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;
            badRequestResult.StatusCode.Should().Be(400);
        }
```

Should_Return_Not_Found_When_Order_Does_Not_Exist_On_Order_Status_Update

Testuojamas užsakymo statuso pakeitimo metodas, kai užsakymas, kurio duomenis norima pakeisti, neegzistuoja.

```
[Fact]
        public async Task
Should_Return_Not_Found_When_Order_Does_Not_Exist_On_Order_Status_Update()
        {
            // Arrange
            _ordersRepository.Setup(mockRep =>
mockRep.GetOrderAsync(It.IsAny<string>())).ReturnsAsync(() => null);

            var controller = new OrdersController(_ordersRepository.Object,
_branchesRepository.Object);

            // Act
            var result = await controller.UpdateOrderStatusAsync(It.IsAny<string>(),
new OrderUpdateDto());

            // Assert
            var notFoundResult = result.Should().BeOfType<NotFoundResult>().Subject;
            notFoundResult.StatusCode.Should().Be(404);
        }
```

Should_Return_Internal_Server_Error_When_Order_Changes_Are_Not_Saved_On_Order_Status_Update
Testuojamas užsakymo statuso pakeitimo metodas, kai pakeisti užsakymo duomenys nėra išsaugomi.

```
[Fact]
        public async Task
Should_Return_Internal_Server_Error_When_Order_Changes_Are_Not_Saved_On_Order_Status
_Update()
        {
            // Arrange
            _ordersRepository.Setup(mockRep =>
mockRep.GetOrderAsync(It.IsAny<string>())).ReturnsAsync(new Order());

            _ordersRepository.Setup(mockRep => mockRep.Save()).Returns(false);

            var controller = new OrdersController(_ordersRepository.Object,
_branchesRepository.Object);

            // Act
            var result = await controller.UpdateOrderStatusAsync(It.IsAny<string>(),
new OrderUpdateDto());

            // Assert
            var internalServerError =
result.Should().BeOfType<ObjectResult>().Subject;

            internalServerError.StatusCode.Should().Be(500);
            internalServerError.Value.Should().Be("A problem happened while handling
your request.");
        }
```

Should_Return_Updated_Order_On_Order_Status_Update

Testuojamas užsakymo statuso pakeitimo metodas, kai pakeisti užsakymo duomenys yra išsaugomi.

```
[Fact]
        public async Task Should_Return_Updated_Order_On_Order_Status_Update()
        {
            // Arrange
            _ordersRepository.Setup(mockRep =>
mockRep.GetOrderAsync(It.IsAny<string>())).ReturnsAsync(new Order());

            _ordersRepository.Setup(mockRep => mockRep.Save()).Returns(true);

            var controller = new OrdersController(_ordersRepository.Object,
_branchesRepository.Object);

            // Act
            var result = await controller.UpdateOrderStatusAsync(It.IsAny<string>(),
new OrderUpdateDto());

            // Assert
            // Verify that Save method was called once in ordersRepository
            _ordersRepository.Verify(mockRep => mockRep.Save(), Times.Once);

            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;
            okResult.StatusCode.Should().Be(200);

            var updatedOrder =
okResult.Value.Should().BeAssignableTo<OrderDto>().Subject;
            updatedOrder.Should().NotBeNull();
        }
```

5. **BranchesController** komponentų testai:

Should_Not_be_Null_With_Valid_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su teisingais parametrais.

```
[Fact]
        public void Should_Not_Be_Null_With_Valid_Parameters()
        {
            // Arrange

            // Act
            var controller = new BranchesController(_branchesRepository.Object,
_usersRepository.Object);

            // Assert
            var branchesController =
controller.Should().BeOfType<BranchesController>().Subject;
            branchesController.Should().NotBeNull();
        }
```

Should_Not_Be_Null_With_Null_Parameters
Testuojamas kontrolerio konstruktoriaus sukūrimas su tuščiais parametrais.

```
[Fact]
        public void Should_Not_Be_Null_With_Null_Parameters()
        {
            // Arrange
```

```
            // Act
            var controller = new BranchesController(null, null);

            // Assert
            var branchesController =
controller.Should().BeOfType<BranchesController>().Subject;
            branchesController.Should().NotBeNull();
        }
```

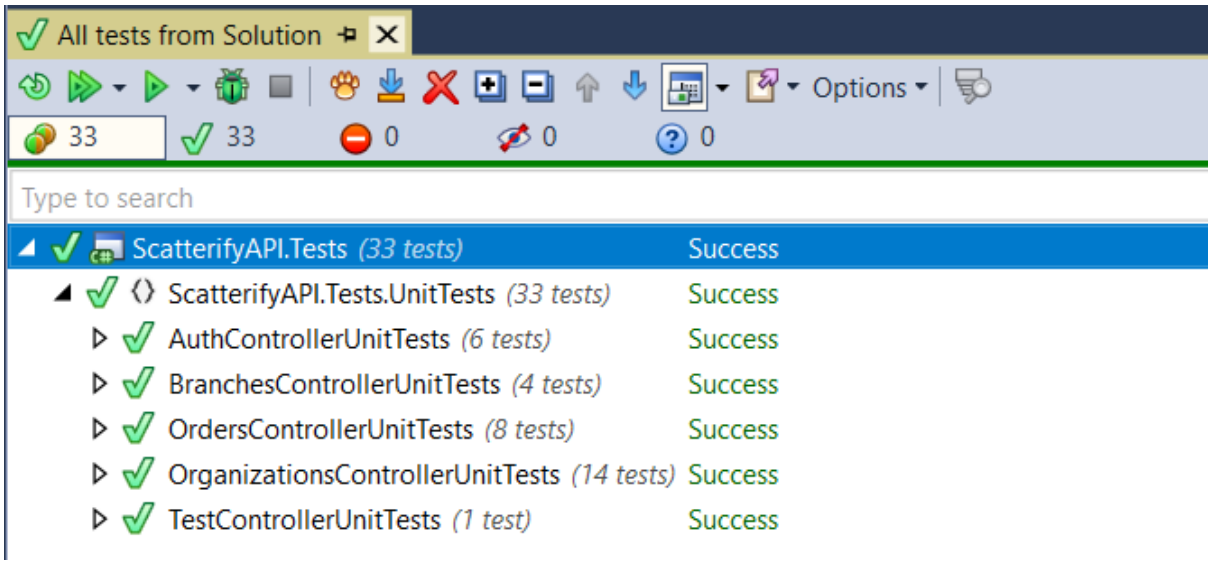
Should_Return_Branches_With_Top_Organization_List_When_User_Exists
Testuojamas GetBranches() metodas, kai prekybos vietos yra sėkmingai grąžinamos.

```
[Fact]
        public void
Should_Return_Branches_With_Top_Organization_List_When_User_Exists()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(_request.Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => new User());

            _branchesRepository.Setup(mockRep =>
mockRep.GetBranches(It.IsAny<User>())).Returns(() => new
List<BranchesWithOrganizationResponseDto>
            {
                new BranchesWithOrganizationResponseDto{organizationTitle="title1",
organizationResourceID=new Guid().ToString(), organizationBranches=new
List<BranchResponseDto>()},
                new BranchesWithOrganizationResponseDto{organizationTitle="title2",
organizationResourceID=new Guid().ToString(), organizationBranches=new
List<BranchResponseDto>()},
                new BranchesWithOrganizationResponseDto{organizationTitle="title3",
organizationResourceID=new Guid().ToString(), organizationBranches=new
List<BranchResponseDto>()}
            });

            var controller = new BranchesController(_branchesRepository.Object,
_usersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = controller.GetBranches();

            // Assert
            var okResult = result.Should().BeOfType<OkObjectResult>().Subject;
            var organizations =
okResult.Value.Should().BeAssignableTo<IEnumerable<BranchesWithOrganizationResponseD
to>>().Subject;

            organizations.Count().Should().Be(3);
        }
```

Should_Return_Bad_Request_When_User_Is_Null
Testuojamas GetBranches() metodas, kai autentifikuotas naudotojas nėra randamas.

```
[Fact]
        public void Should_Return_Bad_Request_When_User_Is_Null()
        {
            // Arrange
            _context.Setup(c => c.Request).Returns(_request.Object);

            _usersRepository.Setup(mockRep =>
mockRep.GetAuthenticatedUser(It.IsAny<HttpRequest>())).Returns(() => null);

            var controller = new BranchesController(_branchesRepository.Object,
_usersRepository.Object)
            {
                ControllerContext = new ControllerContext
                {
                    HttpContext = _context.Object
                }
            };

            // Act
            var result = controller.GetBranches();

            // Assert
            var badRequestResult =
result.Should().BeOfType<BadRequestResult>().Subject;

            badRequestResult.StatusCode.Should().Be(400);
        }
```

Naudojantis ReSharper testų paleidimo įrankiu nustatyta, kad visi testai yra teisingi (3 pav.)



3 pav. Sukurti komponentų testai yra teisingi

7. API programos kodo padengimas testais po testų sukūrimo

Sukūros komponentų testus dar kartą buvo panaudotas įrankis dotCover, kuris šįkart jau parodė, kad visi API metodai yra 100% padengti testais (4 pav.).

Coverage Tree | Hot Spots

Type to search

Symbol	Coverage (%)	Uncovered/Total Stmts.
ScatterifyAPI.Controllers	100%	0/115
OrganizationsController	100%	0/51
OrdersController	100%	0/27
AuthController	100%	0/22
BranchesController	100%	0/12
TestController	100%	0/3

4 pav. Testuojamo kodo padengimas testais

Taip pat prie API metodų kodo eilučių yra rodomi žali laukeliai, kurie nurodo, kad API metodų kodo eilutės yra padengtos testais (5 pav.).

```
9   public class BranchesController : Controller
10  {
11      private readonly IBranchesRepository _branchesRepository;
12      private readonly IUsersRepository _usersRepository;
13
        4 references | 3/3 passing | mangirdaskazlauskas, 22 days ago | 1 author, 1 change | 0 exceptions
14      public BranchesController(IBranchesRepository branchesRepository, IUsersRepository usersRepository)
15      {
16          _branchesRepository = branchesRepository;
17          _usersRepository = usersRepository;
18      }
19      [HttpGet]
        2 references | 1/1 passing | mangirdaskazlauskas, 17 hours ago | 1 author, 3 changes | 1 request | 0 exceptions
20      public IActionResult GetBranches()
21      {
22          var user = _usersRepository.GetAuthenticatedUser(HttpContext.Request);
23          if (user == null)
24          {
25              return BadRequest();
26          }
27          return Ok(_branchesRepository.GetBranches(user));
28      }
29  }
30 }
```

5 pav. API programos kodo eilutės yra padengtos testais

8. Išvados

1. Laboratoriniam darbui atlikti buvo surastos, kaip vėliau paaiškėjo, tinkamos priemonės sistemos komponentų testavimui;
2. Prieš realizuojant testus buvo išsiaiškinta, kaip reikia tinkamai aprašyti komponentų vienetų testus bei kaip juos reikia tinkamai aprašyti programos kodu;
3. Komponentų testais buvo padengti visi API metodai;
4. Kodo padengimas po testų sukūrimo rodo, kad komponentų vienetų testais buvo sėkmingai padengta 100% API programos kodo.