

Integrated Tests:

The screenshot displays an IDE's integrated test runner interface. At the top, the title bar reads 'Cover examsystem in ExamSystem'. Below the title bar is a toolbar with icons for running, debugging, and other test-related actions. The main area is divided into two panes. The left pane shows a tree view of the test results, with a root node 'examsystem (comp3111)' and several sub-nodes representing different test classes and their methods. The right pane shows a summary of the test results, indicating that all tests passed.

Test Results Summary:

- ✓ examsystem (comp3111) 30 ms
 - ✓ EntityTest 11 ms
 - ✓ testParameterizedConstructorAnd() 11 ms
 - ✓ testCompareTo()
 - ✓ testSetter()
 - ✓ testDefaultConstructor()
 - ✓ ManagerTest
 - ✓ testAuthenticate_Fail_Username()
 - ✓ testAuthenticate_Success()
 - ✓ testAuthenticate_Fail_Password()
 - ✓ testAuthenticate_Fail_Both()
 - ✓ StudentManagementServiceTest 7 ms
 - ✓ TestAddStudentSuccess() 3 ms
 - ✓ TestAddStudentFail() 1 ms
 - ✓ TestUpdateStudentFail() 3 ms
 - ✓ CourseTest
 - ✓ testGetDepartment()
 - ✓ testSetDepartment()
 - ✓ testGetCourseName()
 - ✓ testSetCourseName()
 - ✓ testSetCourseId()
 - ✓ testGetCourseId()
 - ✓ StudentExamServiceTest 2 ms
 - ✓ testAddGrade() 2 ms
 - ✓ ExamTest
 - ✓ testConstructorAndGetters()
 - ✓ testSetters()
 - ✓ testDefaultConstructor()
 - ✓ TeacherRegisterServiceTest
 - ✓ testCheckUsernameExists()
 - ✓ testCheckUsernameDoesNotExist()
 - ✓ testAddTeacher()

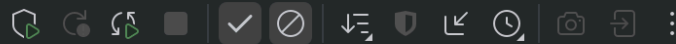
Tests passed: 87 of 87 tests – 30 ms



- ✓ QuestionServiceTest
 - ✓ testUpdateQuestion()
 - ✓ testDeleteQuestion()
 - ✓ testGetAllQuestions()
 - ✓ testAddQuestion()
- ✓ CourseRegistrationRecordManagemen 5 ms
 - ✓ TestDeleteCourseRegistrationRecoi 3 ms
 - ✓ TestAddCourseRegistrationRecordS 1 ms
 - ✓ TestDeleteCourseRegistrationRecordFail()
 - ✓ TestAddCourseRegistrationRecordF 1 ms
- ✓ StudentTest
 - ✓ testGetAgeAsInteger()
 - ✓ testSetAgeUsingInteger()
 - ✓ testConstructorAndGetters()
 - ✓ testSetters()
 - ✓ testDefaultConstructor()
- ✓ TeacherTest
 - ✓ testConstructorAndGetters()
 - ✓ testGetIntegerAge()
 - ✓ testSetters()
 - ✓ testDefaultConstructor()
- ✓ GradeTest 3 ms
 - ✓ testGettersAndSetters()
 - ✓ testGetCourseNum() 1 ms
 - ✓ testGetExamName()
 - ✓ testSetAndGetTimeSpent()
 - ✓ testGetStudentName() 1 ms
 - ✓ getCourseKey() 1 ms
 - ✓ testConstructor()
 - ✓ testDefaultConstructor()
- ✓ StudentRegisterServiceTest
 - ✓ testAddStudent()

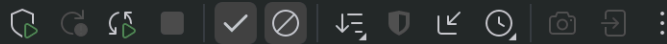
✓ Tests passed: 87 of 87 tests – 30 ms

Cover examsystem in ExamSystem x



- ✓ StudentRegisterServiceTest
 - ✓ testAddStudent()
- ✓ CourseRegRecordTest
 - ✓ testParameterizedConstructorAndGetters()
 - ✓ testSetters()
 - ✓ testDefaultConstructor()
- ✓ ExamServiceTest
 - ✓ testAddQuestionToExam()
 - ✓ testAddExam()
 - ✓ testGetAllExams()
 - ✓ testDeleteQuestionFromExam()
 - ✓ testDeleteGradesForExam()
 - ✓ testGetRecordsForExam()
 - ✓ testDeleteExam()
 - ✓ testDeleteRecordsForExam()
- ✓ TeacherManagementServiceTest
 - ✓ testUpdateTeacherFail()
 - ✓ testUpdateTeacherTrue()
 - ✓ testDeleteTeacherTrue()
 - ✓ testAddTeacherTrue()
 - ✓ testDeleteTeacherFalse()
 - ✓ testAddTeacherFalse()
- ✓ RecordTest
 - ✓ testGetExamName()
 - ✓ testGetExamNameWithValidExamId()
 - ✓ testGetQuestion()
 - ✓ testGetQuestionScore()
 - ✓ testGetQuestionName()
 - ✓ testGetQuestionType()
 - ✓ testConstructor()
 - ✓ testDefaultConstructor()

✓ Tests passed: 87 of 87 tests – 30 ms



- ✓ testGetRecordsForExam()
- ✓ testDeleteExam()
- ✓ testDeleteRecordsForExam()
- ✓ TeacherManagementServiceTest
 - ✓ testUpdateTeacherFail()
 - ✓ testUpdateTeacherTrue()
 - ✓ testDeleteTeacherTrue()
 - ✓ testAddTeacherTrue()
 - ✓ testDeleteTeacherFalse()
 - ✓ testAddTeacherFalse()
- ✓ RecordTest
 - ✓ testGetExamName()
 - ✓ testGetExamNameWithValidExamId()
 - ✓ testGetQuestion()
 - ✓ testGetQuestionScore()
 - ✓ testGetQuestionName()
 - ✓ testGetQuestionType()
 - ✓ testConstructor()
 - ✓ testDefaultConstructor()
- ✓ QuestionTest 2 ms
 - testToString() 2 ms
 - ✓ testTypeVariations()
 - ✓ testConstructorAndGetters()
 - ✓ testEquals()
 - ✓ testSetters()
 - ✓ testDefaultConstructor()
- ✓ CourseManagementServiceTest
 - ✓ testAddCourseSuccess()
 - ✓ testDeleteCourseFail()
 - ✓ testAddCourseFail()
 - ✓ testModifyCourseSuccess()
 - ✓ testModifyCourseFail()
 - ✓ testDeleteCourseSuccess()

✓ Tests passed: 87 of 87 tests – 30 ms

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Coverage examsystem in ExamSystem

Element	Class, %	Method, %	Line, %	Branch, % ^
comp3111.examsystem	51% (23/45)	48% (170/354)	28% (586/2080)	30% (285/934)
MsgSender	0% (0/1)	0% (0/2)	0% (0/10)	0% (0/2)
controller	4% (1/21)	1% (2/165)	0% (2/1349)	0% (0/554)
FileUtil	100% (1/1)	100% (2/2)	75% (18/24)	37% (3/8)
Database	100% (1/1)	68% (15/22)	61% (126/205)	53% (71/132)
service	100% (9/9)	83% (26/31)	86% (220/254)	87% (181/208)
CourseRegistrationRecordManagementService	100% (1/1)	100% (2/2)	96% (32/33)	79% (19/24)
CourseManagementService	100% (1/1)	100% (3/3)	85% (42/49)	82% (41/50)
StudentManagementService	100% (1/1)	66% (2/3)	66% (41/62)	82% (51/62)
TeacherManagementService	100% (1/1)	100% (3/3)	98% (54/55)	96% (56/58)
QuestionService	100% (1/1)	100% (4/4)	100% (4/4)	100% (0/0)
StudentRegisterService	100% (1/1)	100% (1/1)	100% (8/8)	100% (0/0)
StudentExamService	100% (1/1)	100% (1/1)	100% (10/10)	100% (0/0)
TeacherRegisterService	100% (1/1)	100% (2/2)	100% (6/6)	100% (4/4)
ExamService	100% (1/1)	66% (8/12)	85% (23/27)	100% (10/10)
Main	0% (0/1)	0% (0/2)	0% (0/7)	100% (0/0)
DatabaseService	100% (1/1)	93% (15/16)	95% (22/23)	100% (0/0)
entity	100% (10/10)	96% (110/114)	95% (198/208)	100% (30/30)
Entity	100% (1/1)	100% (5/5)	100% (7/7)	100% (0/0)
Teacher	100% (1/1)	100% (17/17)	100% (26/26)	100% (0/0)
CourseRegRecord	100% (1/1)	75% (6/8)	57% (8/14)	100% (0/0)
Exam	100% (1/1)	90% (10/11)	82% (14/17)	100% (0/0)
Course	100% (1/1)	88% (8/9)	91% (11/12)	100% (0/0)
Student	100% (1/1)	100% (16/16)	100% (26/26)	100% (2/2)
Manager	100% (1/1)	100% (1/1)	100% (1/1)	100% (2/2)
Question	100% (1/1)	100% (20/20)	100% (31/31)	100% (8/8)
Grade	100% (1/1)	100% (16/16)	100% (41/41)	100% (8/8)
Record	100% (1/1)	100% (11/11)	100% (33/33)	100% (10/10)

Task 1:

- Service

StudentRegisterServiceTest:

The screenshot shows the IntelliJ IDEA IDE with the `StudentRegisterServiceTest` class open. The `testAddStudent()` method is highlighted, and the test results panel shows that the test passed successfully. The coverage report indicates that the test covered 100% of the code in the `StudentRegisterService` class.

```
package com.comp3111.examsystem.service;

import com.comp3111.examsystem.entity.Exam;
import com.comp3111.examsystem.entity.ExamService;
import org.junit.jupiter.api.Test;
import java.util.ArrayList;
import java.util.List;
import static org.junit.jupiter.api.Assertions.*;

public class StudentRegisterServiceTest {

    private DatabaseService databaseService;

    @Test
    void testAddStudent() {
        // Test logic for adding a student
    }
}
```

Test Results:

Element	Class, %	Method, %	Line, %	Branch, %
comp3111.examsystem.service	100% (2/2)	100% (2/2)	100% (18/18)	100% (0/0)
StudentExamService	100% (1/1)	100% (1/1)	100% (10/10)	100% (0/0)
StudentRegisterService	100% (1/1)	100% (1/1)	100% (8/8)	100% (0/0)

Test Results Summary:

- StudentRegisterServiceTest: 1 test passed, 0 failed, 0 skipped, 60 ms
- testAddStudent(): 60 ms

Process finished with exit code 0

StudentExamServiceTest:

The screenshot shows the IntelliJ IDEA IDE with the `StudentExamServiceTest` class open. The `testAddGrade()` method is highlighted, and the test results panel shows that the test passed successfully. The coverage report indicates that the test covered 100% of the code in the `StudentExamService` class.

```
import java.time.LocalDate;
import java.util.List;
import static org.junit.jupiter.api.Assertions.*;

public class StudentExamServiceTest {

    private DatabaseService databaseService;
    private Exam exam;
    private LocalDate timeRemaining;

    @BeforeEach
    void setUp() {
        // Initialize the in-memory database
        databaseService.setGradeDatabaseService();
    }

    @Test
    void testAddGrade() {
        // Test logic for adding a grade
    }
}
```

Test Results:

Element	Class, %	Method, %	Line, %	Branch, %
comp3111.examsystem.service	100% (2/2)	100% (2/2)	100% (18/18)	100% (0/0)
StudentExamService	100% (1/1)	100% (1/1)	100% (10/10)	100% (0/0)
StudentRegisterService	100% (1/1)	100% (1/1)	100% (8/8)	100% (0/0)

Test Results Summary:

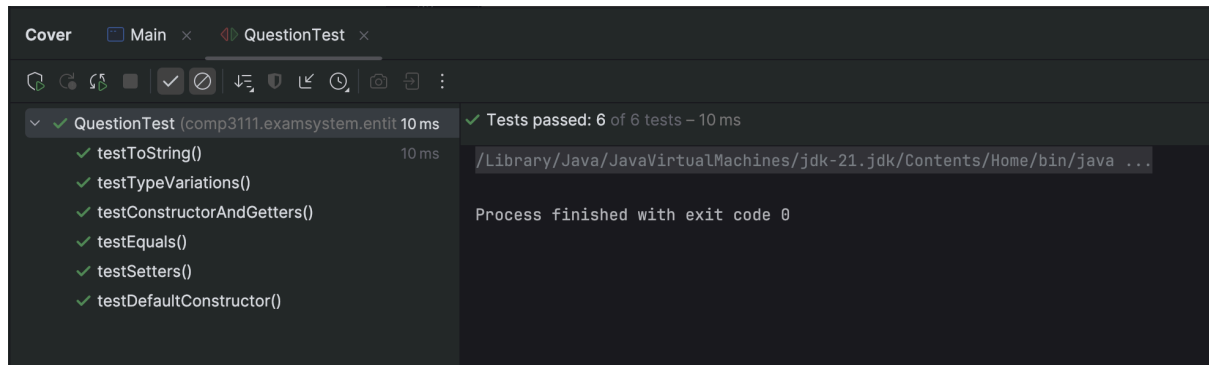
- StudentExamServiceTest: 1 test passed, 0 failed, 0 skipped, 50 ms
- testAddGrade(): 50 ms

Process finished with exit code 0

Task 2:

- Entities

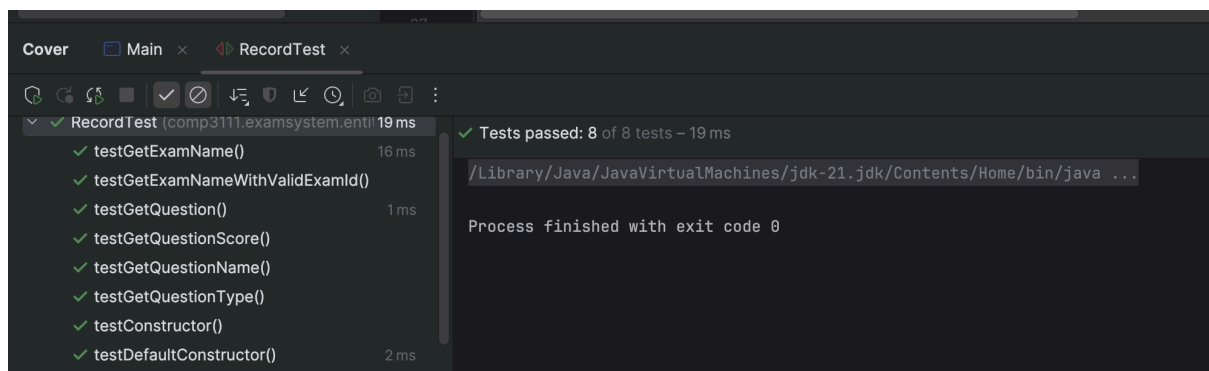
QuestionTest:



Coverage QuestionTest x

Element	Class, %	Method, %	Line, %	Branch...
comp3111.examsystem.entity	20% (2/10)	19% (22/114)	16% (34/208)	26% (8/30)
Student	0% (0/1)	0% (0/16)	0% (0/26)	0% (0/2)
Manager	0% (0/1)	0% (0/1)	0% (0/1)	0% (0/2)
Grade	0% (0/1)	0% (0/16)	0% (0/41)	0% (0/8)
Record	0% (0/1)	0% (0/11)	0% (0/33)	0% (0/10)
Entity	100% (1/1)	40% (2/5)	42% (3/7)	100% (0/0)
Teacher	0% (0/1)	0% (0/17)	0% (0/26)	100% (0/0)
CourseRegRecord	0% (0/1)	0% (0/8)	0% (0/14)	100% (0/0)
Exam	0% (0/1)	0% (0/11)	0% (0/17)	100% (0/0)
Course	0% (0/1)	0% (0/9)	0% (0/12)	100% (0/0)
Question	100% (1/1)	100% (20/20)	100% (31/31)	100% (8/8)

RecordTest:



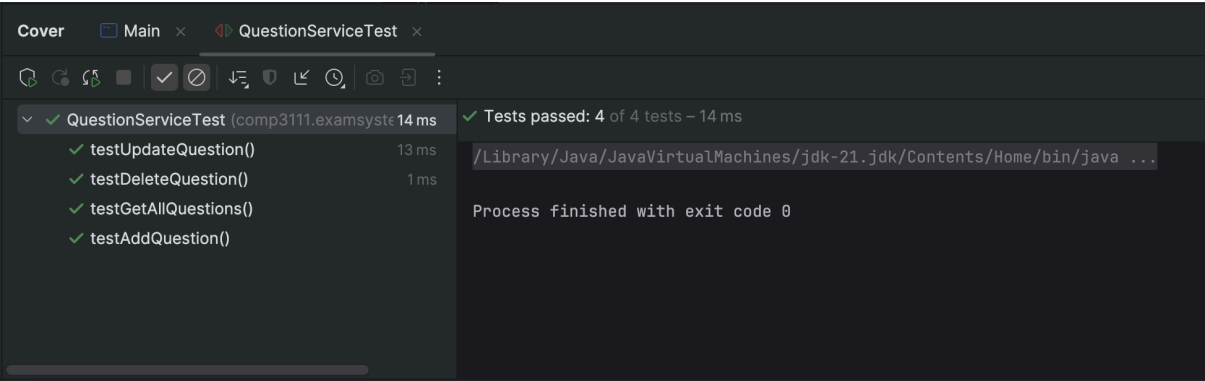
Coverage RecordTest				
Element	Class, %	Method, %	Line, %	Branch...
comp3111.examsystem.entity	40% (4/10)	14% (17/114)	19% (41/208)	33% (10/30)
Student	0% (0/1)	0% (0/16)	0% (0/26)	0% (0/2)
Manager	0% (0/1)	0% (0/1)	0% (0/1)	0% (0/2)
Question	100% (1/1)	20% (4/20)	12% (4/31)	0% (0/8)
Grade	0% (0/1)	0% (0/16)	0% (0/41)	0% (0/8)
Entity	100% (1/1)	40% (2/5)	57% (4/7)	100% (0/0)
Teacher	0% (0/1)	0% (0/17)	0% (0/26)	100% (0/0)
CourseRegRecord	0% (0/1)	0% (0/8)	0% (0/14)	100% (0/0)
Exam	100% (1/1)	18% (2/11)	11% (2/17)	100% (0/0)
Course	0% (0/1)	0% (0/9)	0% (0/12)	100% (0/0)
Record	100% (1/1)	81% (9/11)	93% (31/33)	100% (10/10)

- Service:

TeacherRegisterServiceTest:

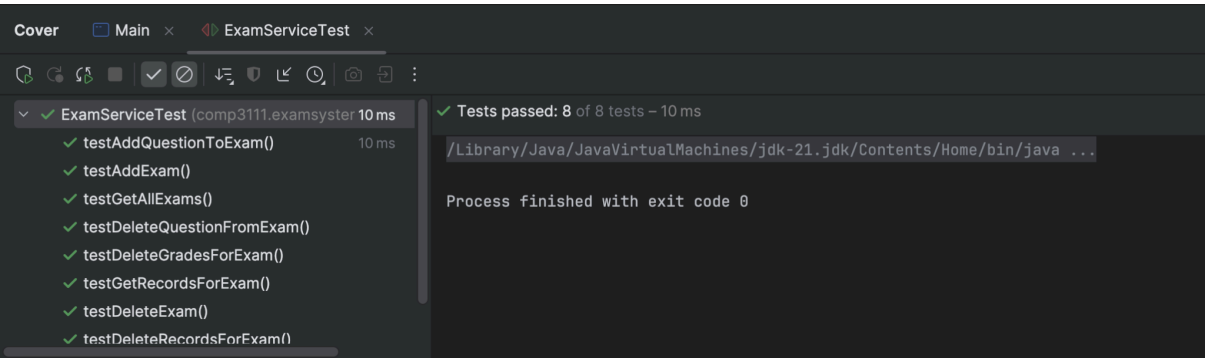
Coverage TeacherRegisterServiceTest				
Element	Class, %	Method, %	Line, %	Branch...
comp3111.examsystem.service	11% (1/9)	6% (2/32)	2% (6/244)	1% (4/208)
StudentRegisterService	0% (0/1)	0% (0/2)	0% (0/6)	0% (0/4)
ExamService	0% (0/1)	0% (0/12)	0% (0/27)	0% (0/10)
CourseRegistrationRecordManagementService	0% (0/1)	0% (0/2)	0% (0/33)	0% (0/22)
CourseManagementService	0% (0/1)	0% (0/3)	0% (0/49)	0% (0/48)
TeacherManagementService	0% (0/1)	0% (0/3)	0% (0/55)	0% (0/58)
StudentManagementService	0% (0/1)	0% (0/3)	0% (0/62)	0% (0/62)
QuestionService	0% (0/1)	0% (0/4)	0% (0/4)	100% (0/0)
StudentLoginService	0% (0/1)	0% (0/1)	0% (0/2)	100% (0/0)
TeacherRegisterService	100% (1/1)	100% (2/2)	100% (6/6)	100% (4/4)

QuestionServiceTest:



Coverage QuestionServiceTest x				
Element				
	Class, %	Method, %	Line, %	Branch...
✓ comp3111.examsystem.service	11% (1/9)	12% (4/32)	1% (4/244)	0% (0/208)
⊙ StudentRegisterService	0% (0/1)	0% (0/2)	0% (0/6)	0% (0/4)
⊙ TeacherRegisterService	0% (0/1)	0% (0/2)	0% (0/6)	0% (0/4)
⊙ ExamService	0% (0/1)	0% (0/12)	0% (0/27)	0% (0/10)
⊙ CourseRegistrationRecordManagementService	0% (0/1)	0% (0/2)	0% (0/33)	0% (0/22)
⊙ CourseManagementService	0% (0/1)	0% (0/3)	0% (0/49)	0% (0/48)
⊙ TeacherManagementService	0% (0/1)	0% (0/3)	0% (0/55)	0% (0/58)
⊙ StudentManagementService	0% (0/1)	0% (0/3)	0% (0/62)	0% (0/62)
⊙ QuestionService	100% (1/1)	100% (4/4)	100% (4/4)	100% (0/0)
⊙ StudentLoginService	0% (0/1)	0% (0/1)	0% (0/2)	100% (0/0)

ExamServiceTest:



Coverage ExamServiceTest x				
Element	Class, %	Method, %	Line, %	Branch... ^
<div> <div> </div> <div>comp3111.examsystem.service</div> </div>	11% (1/9)	25% (8/32)	9% (23/244)	4% (10/208)
<div> <div> </div> <div>StudentRegisterService</div> </div>	0% (0/1)	0% (0/2)	0% (0/6)	0% (0/4)
<div> <div> </div> <div>TeacherRegisterService</div> </div>	0% (0/1)	0% (0/2)	0% (0/6)	0% (0/4)
<div> <div> </div> <div>CourseRegistrationRecordManagementService</div> </div>	0% (0/1)	0% (0/2)	0% (0/33)	0% (0/22)
<div> <div> </div> <div>CourseManagementService</div> </div>	0% (0/1)	0% (0/3)	0% (0/49)	0% (0/48)
<div> <div> </div> <div>TeacherManagementService</div> </div>	0% (0/1)	0% (0/3)	0% (0/55)	0% (0/58)
<div> <div> </div> <div>StudentManagementService</div> </div>	0% (0/1)	0% (0/3)	0% (0/62)	0% (0/62)
<div> <div> </div> <div>QuestionService</div> </div>	0% (0/1)	0% (0/4)	0% (0/4)	100% (0/0)
<div> <div> </div> <div>StudentLoginService</div> </div>	0% (0/1)	0% (0/1)	0% (0/2)	100% (0/0)
<div> <div> </div> <div>ExamService</div> </div>	100% (1/1)	66% (8/12)	85% (23/27)	100% (10/10)

Task3:

Entities:

Course, CourseRegRecord, Entity,Exam, Grade, Manager, Student, Teacher

<div> <div> </div> <div>Course</div> </div>	100% (1/1)	88% (8/9)	91% (11/12)	100% (0/0)
<div> <div> </div> <div>CourseRegRecord</div> </div>	100% (1/1)	75% (6/8)	57% (8/14)	100% (0/0)
<div> <div> </div> <div>Entity</div> </div>	100% (1/1)	100% (5/5)	100% (7/7)	100% (0/0)
<div> <div> </div> <div>Exam</div> </div>	100% (1/1)	90% (10/11)	82% (14/17)	100% (0/0)
<div> <div> </div> <div>Grade</div> </div>	100% (1/1)	100% (16/16)	100% (41/41)	100% (8/8)
<div> <div> </div> <div>Manager</div> </div>	100% (1/1)	100% (1/1)	100% (1/1)	100% (2/2)
<div> <div> </div> <div>Student</div> </div>	100% (1/1)	100% (16/16)	100% (26/26)	100% (2/2)
<div> <div> </div> <div>Teacher</div> </div>	100% (1/1)	100% (17/17)	100% (26/26)	100% (0/0)

Service:

CourseManagementService, CourseRegisterRecordService,StudentManagementService,TeaherManagementService

<div> <div> </div> <div>CourseManagementService</div> </div>	100% (1/1)	100% (3/3)	83% (41/49)	81% (39/48)
<div> <div> </div> <div>CourseRegistrationRecordManagementService</div> </div>	100% (1/1)	100% (2/2)	93% (31/33)	72% (16/22)
<div> <div> </div> <div>StudentManagementService</div> </div>	100% (1/1)	66% (2/3)	66% (41/62)	82% (51/62)
<div> <div> </div> <div>TeacherManagementService</div> </div>	100% (1/1)	100% (3/3)	98% (54/55)	98% (57/58)

Student, Teacher Entities

```

  ✓ StudentTest 12 ms
    ✓ testGetAgeAsInteger() 12 ms
    ✓ testSetAgeUsingInteger()
    ✓ testConstructorAndGetters()
    ✓ testSetters()
    ✓ testDefaultConstructor()
  ✓ TeacherTest
    ✓ testConstructorAndGetters()
    ✓ testGetIntegerAge()
    ✓ testSetters()
    ✓ testDefaultConstructor()
/Library/Java/JavaVirtualMachines/jdk-21.jdk/Contents/Home/bin/java ...
Process finished with exit code 0

```

Course reg record, Course, Entity, Exam, Grade, Manager

```

  ✓ CourseRegRecordTest 31 ms
    ✓ testParameterizedConstructor 31 ms
    ✓ testSetters()
    ✓ testDefaultConstructor()
  ✓ CourseTest
    ✓ testGetDepartment()
    ✓ testSetDepartment()
    ✓ testGetCourseName()
    ✓ testSetCourseName()
    ✓ testSetCourseId()
    ✓ testGetCourseId()
  ✓ EntityTest
    ✓ testParameterizedConstructorAndGetters()
    ✓ testCompareTo()
    ✓ testSetter()
    ✓ testDefaultConstructor()
  ✓ ExamTest
    ✓ testConstructorAndGetters()
    ✓ testSetters()
    ✓ testDefaultConstructor()
  ✓ GradeTest 21 ms
    ✓ testGettersAndSetters()
    ✓ testGetCourseNum() 12 ms
    ✓ testGetExamName() 2 ms
    ✓ testSetAndGetTimeSpent()
    ✓ testGetStudentName() 3 ms
    ✓ getCourseKey() 3 ms
    ✓ testConstructor() 1 ms
    ✓ testDefaultConstructor()
  ✓ ManagerTest 1 ms
    ✓ testAuthenticate_Fail_Username() 1 ms
    ✓ testAuthenticate_Success()
    ✓ testAuthenticate_Fail_Password()
    ✓ testAuthenticate_Fail_Both()
/Library/Java/JavaVirtualMachines/jdk-21.jdk/Contents/Home/bin/java ...
Process finished with exit code 0

```

**Student management service, Teacher management service,
Course Reg management service, Course management service**

✓ service (comp3111.examsystem) 61 ms

✓ StudentManagementServiceTest 40 ms

✓ TestAddStudentSuccess() 30 ms

✓ TestAddStudentFail() 3 ms

✓ TestUpdateStudentFail() 7 ms

✓ TeacherManagementServiceTest 10 ms

✓ testUpdateTeacherFail() 2 ms

✓ testUpdateTeacherTrue() 3 ms

✓ testDeleteTeacherTrue() 2 ms

✓ testAddTeacherTrue() 2 ms

✓ testDeleteTeacherFalse() 1 ms

✓ testAddTeacherFalse() 1 ms

✓ CourseRegistrationRecordManage 6 ms

✓ TestDeleteCourseRegistrationf 2 ms

✓ TestAddCourseRegistrationRex 2 ms

✓ TestDeleteCourseRegistrationRecordF 2 ms

✓ TestAddCourseRegistrationRex 2 ms

✓ CourseManagementServiceTest 5 ms

✓ testAddCourseSuccess() 1 ms

✓ testDeleteCourseFail() 1 ms

✓ testAddCourseFail() 1 ms

✓ testModifyCourseSuccess() 1 ms

✓ testModifyCourseFail() 1 ms

✓ testDeleteCourseSuccess() 1 ms

✓ Tests passed: 19 of 19 tests - 61 ms

/Library/Java/JavaVirtualMachines/jdk-21.jdk/Contents/Home/bin/java ...

Process finished with exit code 0