ECSE 321 - Intro to Software Engineering
Design Specification Document - Deliverable 3

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Part I

Unit Test Plan

1 Description

In this section we will present an extensive suite of test cases aimed to cover in the most efficient manner possible the Teaching Assistant Management System (TAMAS) we are to deliver. Following the paradigm of Test-Driven Development, we shall also implement the unit test cases. This will help keep the development of the system on track with the requirements imposed to the team.

To produce high confidence in test results, it is important that the unit tests are designed in a systematic manner that organizes the test cases in such a way that it is clear that all branches in logic are covered. To achieve this, the technique of equivalence partitioning will be exploited. This involves dissecting each test subject into its equivalent input and output partitions, which gives a great foundation concerning how and which unit tests should be written.

It is when the system requires new functionality that the writing and running of tests will be triggered. These tests are designed to fail at first, since they will be written before the code which they attempt to test, as per the philosophy of the Test Driven Development paradigm. The new code will be implemented in order to ensure that these tests pass; further following the Test Driven Development framework. Another trigger for the execution of tests is to reach full statement and branch coverage for the system if it is not already so. Finally, regular systematic tests will be executed to ensure that no editing has caused any unforeseen bugs.

2 Test Cases

All the classes to test will have the following pattern:

CLASS TO TEST/NOT TO TEST

- Reason to test/not to test
- attributes and related tests

2.1 Classes To Test

- **Course**
  - **Reason to test:** This class is intrinsic to the job posting and application transaction. Its attributes TA/Grader time budget define how many students can apply to the position. Less relative to the application, but still needed for the correct behavior of the process is the fact that the student must have experience in the given course in order to apply for a position as TA/Grader for it.
  - **Test Cases:**
    - **className**: test for null, empty, only numerical and only spaces inputs.
    - **CDN**: test for non-unique, null, empty, not alphabetic and only spaces inputs.
    - **className**: test for null, empty, not numerical and only spaces inputs.
    - **graderTimeBudget/taTimeBudget**: test for null, empty, not numerical and negative inputs.

    * **addJob:** test for null, and empty inputs for addJob. test for Time inputs for startTime and endTime, strictly alphabetical input for Day, and Requirements, default instructor input for Instructor, and strictly numerical input for salary.
    * **addJobAt and addOrMoveJobAt:** test for adding job at a null position, moving existing Job at an incrementally higher and at an incrementally smaller position than it is already at, and at a position that is already occupied.
    * **Retrieval:** test for successful retrieval of non-null className, CDN, number of and minimum number of jobs, Grader Time Budget, Job, List of Job objects, and Ta Time Budget.
    * **Delete and Removal:** test for successful and failure of removal of a Job object, and successful and failure of deletion of a Course object.

- **Job**
  - **Reason to test:** This class is intrinsic to the job posting and application transaction. It encapsulates half of the persistence aspect of the app which is to publish and view job postings.
  - **Test Cases:**
    * **CDN**: test for non-existent, null, empty, only numerical and only spaces inputs.
    * **requirements**: test for null, empty, empty and only spaces inputs.
    * **position**: test for null inputs.
    * **salary**: test for null, empty, not numerical and negative inputs.
    * **day**: test for null, empty and weekend inputs.
    * **startTime/endTime**: test for null, empty and outside of working hours inputs.
    * **Retrieval:** test for successful retrieval for all getter methods.

- **Tutorial**
  - **Reason to test:** This class is intrinsic to the job posting and application transaction. Job postings are for either TA/Grader. In the first case, the availabilities of the TA must be compatible with those of the tutorial.
  - **Test Cases:**
    * test the same attributes as Course to ensure inheritance was correctly implemented by the UML

- **Laboratory**
  - **Reason to test:** This class is intrinsic to the job posting and application transaction. Job postings are for either TA/Grader. In the first case, the availabilities of the TA must be compatible with those of the laboratory.
  - **Test Cases:**
    * test the same attributes as Course to ensure inheritance was correctly implemented by the UML

- **Profile**

- **Reason to test:** This class is intrinsic to the job posting and application transaction. The system requires profile identifiers to discern which methods and attributes each instance has access to.
- **Test Cases:**
  - **id**:test for non-unique, null, empty, not alphabetic and only spaces inputs.
  - **username**: test for non-unique, null, empty, not alphanumeric and only spaces inputs.
  - **password**: test for invalid difficulty, null and empty inputs.
  - **firstName/lastName**: test for null, empty, not alphabetical and only spaces inputs.

- **Student**
  - **Reason to test:** This class is intrinsic to the job posting and application transaction. The student is the only instance of profile allowed to apply to a job posting.
  - **Test Cases:**
    - test the same attributes as Profile to ensure inheritance was correctly implemented by the UML
    - **experience**: test for null, empty and only spaces inputs.
    - **degree**: test for null inputs.
    - **Jobs**: test for retrieval of job list

- **Instructor**
  - **Reason to test:** This class is intrinsic to the job posting and application transaction. The instructor is the only instance of profile allowed to post jobs.
  - **Test Cases:**
    - test the same attributes as Profile to ensure inheritance was correctly implemented by the UML
    - **experience**: test for null, empty and only spaces inputs.
    - **degree**: test for null inputs.
    - **Jobs**: test for retrieval and modification of job list
    - **Application**: test for retrieval of application list
    - **course**: test for retrieval of course list

- **Application**
  - **Reason to test:** This class is necessary for the Student to apply for a job. Each application is associated to a student and a job posting; hence one needs to test for different Student attributes for different Jobs.
  - **Test Cases:**
    - **Test Apply for a Job:** test for error if hours are not compatible, test for error if job is null, and test for error if student is null.

- **Admin**

- **Reason to test:** This class is intrinsic to the creation of a course, the creation of a Student and Instructor, and application transaction. Its attributes inherit from profile. They define information about the person that is registering an admin profile; hence it is needed to test for different attribute inputs and for successful creation of classes.
- **Test Cases:**
  - test the same attributes as Profile to ensure inheritance was correctly implemented by the UML
  - **Application Transaction:** test for successful application transaction between Student and Job Posting
  - **Successfully Create Classes:** test to successfully create Instructor, and Student.

- **Persistence**
  - **Reason to test:** This class is intrinsic to the job posting and application transaction. Without persistence capability the controllers have no data from which to derive the desired outcome
  - **Test Cases:**
    - creation, modification and deletion of Course, Job, Application and Profile instances.

2.2 Classes to Not Test

- **Application Manager**
  - **Reason to not test:** This class acts as a container for Application and Job classes. There is no unit test to be done on the ApplicationManager class. Testing for persistence of this manager class and its relation to Application and Job are not to be done with unit tests.

- **Profile Manager**
  - **Reason to not test:** This class acts as a container for Student, Instructor and Admin classes. There is no unit test to be done on the ProfileManager class. Testing for persistence of this manager class and its relation to Student, Instructor and Admin are not to be done with unit tests.

- **Course Manager**
  - **Reason to not test:** This class acts as a container for Course class. There is no unit test to be done on the CourseManager class. Testing for persistence of this manager class and its relation to Course are not to be done with unit tests.

3 Techniques and Tools

The system is to be designed in a complete Test-Driven Development paradigm. Hence all test cases will be written before the actual controllers are implemented. Furthermore, the order in which the tests will be passed follows the same order as the requirements derived in the Requirements

document of deliverable #1. This will aid the classification and prioritization of each bi-weekly runs' objectives. In parallel to this method, the team will rely heavily on code revisions by the senior members of the team to ensure the code written is up to visual, performance and logical standards. In terms of frequency, individual nightly tests will be ran on all platforms of the system and bi-weekly builds and test will be done every Saturday to ensure the deliverable validates and verifies the given requirements. To facilitate the testing process, the team will use the following tools:

- **Unit Test Framework:** Automated, well documented and supported system to allow a standardized set of tests to be done regardless of the platform. JUnit and PHPUnit will be used.
- **Test Coverage Tool:** Ensure that the measure to which the tests and actions cover the source code is optimal by function, statement, branch and condition standards. Its outputs will be used during the code revision sessions. The following tools will be used for these purposes. The tools used for coverage analysis include: EclEmma for Eclipse for the Desktop/Laptop Platform, jacoco Gradle plugin for the mobile platform, and PHPUnit for the web platform.

4 Differences in Unit Testing for the Three Platforms

The differences when it comes to unit testing for the three platforms are: the classes that are to be tested, the tools that are to be used for coverage analysis, and the test unit libraries that are to be used. The desktop/laptop app has all functionality; hence, all unit tests for all of the classes to be tested will be at least done on this platform. The mobile and web apps have less functionality than the desktop/laptop app; hence, there will be less classes to be tested on these two platforms. The JUnit test library will be used for the testing of the desktop/laptop and the mobile platforms. The PHPUnit library and tools will be used for the testing of the web platform. Their coverage analysis tools are also different and each platform's specific coverage tool is mentioned above in Test Coverage Tool. The mobile app is implemented for the student's use; hence, there will be no unit testing for the Admin, Instructor, and Course classes on this platform. More specifically, the plan of unit testing the mobile app is to unit test the Student, Application, and Job classes. The web app is implemented for the instructor's use; hence, there will be no unit testing for the Admin, and Student classes on this platform. More specifically, the plan of unit testing the web app is to unit test the Instructor, Application, Job, and Course classes.

5 Coverage Statistics

Since the plan is to implement certain functionalities in a Test Driven Development paradigm, it will be necessary to execute tests before there is even code written for the test. Tests will be executed often during the development of new functionality and during the verification and validation of existing functionality. In other words, JUnit tests will be written and executed before a certain method is written. JUnit tests will be written and executed shortly after test cases are made for a certain method that is already implemented.

Thus, the goal of the unit tests is to ensure that each minimal unit of the system is functioning correctly, so that these units may serve as a solid foundation for the system. Referring to the

rationale of the test plan, it is clear that each class is tested independently, as well as each method within the class. The main goal behind this strategy is to isolate every area where workflow may lead to different logical steps in the methods, and to attempt to examine the behavior at each of these workflows.

So, based on the structure of the unit test plan, it is clear that each logical path of each method is being examined. The technique of equivalence partitioning is used to organize all possible equivalent input and output patterns, such that it can be assured that each one is verified accordingly. It can then be concluded that all logical branches of the code have been covered. Of course, as the system evolves, the unit test plan may need to evolve as well for such coverage to be attained. Furthermore, until the system is written to more completion, it will be very difficult to ensure that all branches are guaranteed to be covered. As the system develops, using tools such as EclEmma will aid in discovering holes in branch and statement coverage.

As the system currently stands, however, it is believed that the unit test plan above will cover approximately 100% of the branches. It is very difficult to predict state coverage statistics at such an early stage in development, but the goal is to have similar statistics for state coverage as well. Given the 9 classes to test in the Unit Testing Plan, encompassing 34 test cases that must deal with various different input patterns, it is not unrealistic that 100% of branches, as well as statements, can be verified by this team.

Part II

Integration Test Plan

6 Description

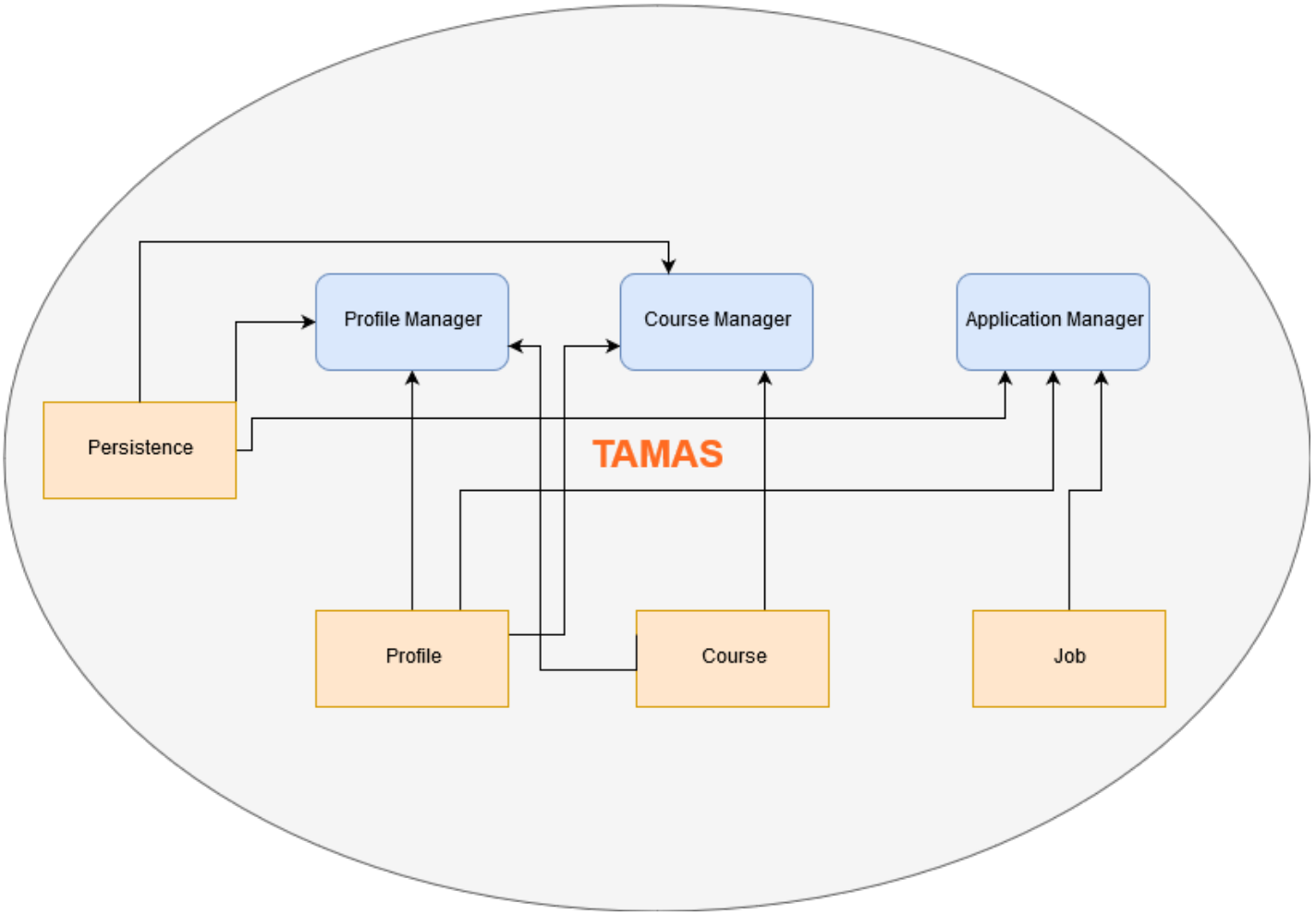
The integration testing is meant to test the relationships between units that form subsystems. The aim is to test all the relationships between classes that form subsystems. Since the Controller classes control all the interactions between classes, they are the classes that will be tested in the integration testing.

7 Integration Strategy

The strategy of integration will follow a bottom-up approach. The system will first have all the unit tests done for each class. Then the controller classes will integrate the units together into discrete subsystems. Since course controller is going to be used on all platforms, it was decided to test this subsystem first. The other subsystems can be tested in parallel on their individual platforms.

7.1 Subsystem Testing Diagram

The following diagram shows the subsystems and interactions that will be tested. The arrows show how each of the orange units relate to the controller subsystems.



7.2 Platform Integration

Since our mobile app is only for students, there is no need to test the course controller on the mobile application. Likewise, the web app will not need to test the application controller since the web app is just for teachers. All the tests that follow are done programmatically rather than through a user interface. For example, Applying for a job will involve just creating an instance of an application and attributing it a profile, a job, etc. The system test will test whether the user can create a form and apply through the mobile application, for example.

8 Integration Test descriptions

8.1 Subsystem Testing

- **Profile Persistence Subsystem Testing**
  - **Reason to test:** These tests will evaluate the relationship between the profiles the persistence layer, this is necessary to ensure that all profile data and associations are properly propagated throughout the system for later use.
  - **Situations:**
    - **Create a profile:** Test to ensure that a profile can properly be created in persistence.
      - Create profile using complete valid profile data (including the courses the profile is involved in) and ensure that it is properly persisted and available to other classes.
      - Attempt to create a profile using invalid or incomplete input data, ensure that it is not propagated in the persistence layer.
      - Attempt to create a profile by giving no input data, ensure that this is not propagated in the persistence layer.
    - **Modify a profile:**
      - Modify a profile so that the new profile data is valid, this new profile data should persist.
      - Modify a profile so that the new data is invalid/incomplete, the system should not allow this so the persistence layer will remain unchanged.
    - **Delete a profile:**
      - Deleting a valid profile should remove it's data from the persistence layer.
      - Deleting an invalid/nonexistent profile should be rejected and have no effect on the persistence layer.
- **Course Persistence Subsystem Testing**
  - **Reason to test:** These tests will evaluate the relationship between the courses, the profiles and the persistence layer this is necessary to ensure that all course data and associations are properly propagated throughout the system.
  - **Situations:**
    - **Create a course**

        - Create a course using complete valid course data and ensure that it is properly persisted and available to other classes.
        - Attempt to create a course using invalid or incomplete input data, ensure that it is not propagated in the persistence layer.
        - Attempt to create a course by giving no input data, ensure that this is not propagated in the persistence layer.
    * **Modify a course**
        - Modify a course so that the new data is valid, this new course data should persist.
        - Modify a course so that the new data is invalid/incomplete, the system should not allow this so the persistence layer will remain unchanged.
    * **Delete a course**
        - Deleting a valid course should remove it's data from the persistence layer.
        - Deleting an invalid/nonexistent course should be rejected and have no effect on the persistence layer.

- **Application Persistence Subsystem Testing**
  - **Reason to test:** These tests will evaluate the relationship between the profiles and the jobs that make up the applications and the persistence layer.
  - **Situations:**
    * **Create an application**
        - Create an application using complete valid data and ensure that it is properly persisted and available to other classes.
        - Attempt to create an application using invalid or incomplete input data, ensure that it is not propagated in the persistence layer.
        - Attempt to create an application by giving no input data, ensure that this is not propagated in the persistence layer.
    * **Modify an application**
        - Modify an application so that the new data is valid, this new course data should persist.
        - Modify an application so that the new data is invalid/incomplete, the system should not allow this so the persistence layer will remain unchanged.
    * **Delete an application**
        - Deleting a valid application should remove it's data from the persistence layer.
        - Deleting an invalid/nonexistent application should be rejected and have no effect on the persistence layer.

9 Techniques and Tools

Using EclEmma, we aspire to have near 100% code coverage. This would imply that there should be near 100% statement and branch coverage. The goal is to test the relationship between all the classes.

10 Coverage Statistics

Since there are 3 classes in each subsystem, and the tests should cover all the relationships between the classes, there should be 3! or 6 relationships in each subsytem totaling to 18 relationships. It was decided that it would be more efficient not to create a test for every relationship, but to instead test functionality that includes all these relationships within the tests. For example, creating a profile would test the persistence layer as well as the profile class together. When the profile class is attributed a course within this test, it tests the integration between all three classes. For this reason, we aim for 100% code coverage.

Part III

System Test Plan

11 Description

The purpose of system testing is to validate the functionality of the system as a whole. System tests are black-box tests, meaning they are done without any concern regarding the code - that is to say, only the inputs and outputs are examined.

So as to examine the functionality of the system in an organized and systematic fashion, system tests will be designed according to the various *use cases* of the system. The use cases provide concrete details concerning how each functionality of the system should behave, and in particular how each functionality of the system should react to unexpected or faulty input.

The proposed system tests will be discussed below.

11.1 Administrator-Specific Actions

1. **Sending Student Enrollment Data and Course List**

   (a) Valid data entered

   - Enter appropriate data for student enrollment, as well as the course list, in the desktop application. Ensure that the proper XML files are generated.

   (b) Invalid student enrollment data entered

   - Enter faulty student enrollment data (by omitting names, for example) and enter correct course list data in the desktop application. Ensure that an error message about invalid student data is made present. Moreover, assert that the corresponding student enrollment XML has not been generated at all, and that the course list XML file has been generated appropriately.

   (c) Invalid course list data entered

   - Enter faulty course list data (by omitting required names, or by including non-integral course codes, for example) and enter correct student data in the desktop application. Ensure that an error message about invalid course list data is made present. Moreover, assert that the corresponding course list XML file has not been generated at all, and that the student enrollment XML file has been generated appropriately.

2. **Generating Initial Student Job Placements**

   (a) Valid XML Application file is present

   - Ensure that the appropriate XML file containing data about student applications is present. Use desktop application to generate default TA placement.
     i. Verify that an appropriate XML file containing data about the job offerings was generated.
     ii. Verify that initial placement confines to the budget for each department.
     iii. Verify that graduate students were selected with higher priority than undergraduate students.
     iv. Verify that the same student was selected for as many jobs as possible for the same course.

(b) XML Application file not found or is corrupted

- Place invalid XML file (containing syntax errors or type mismatches, for example) in the appropriate location, and attempt to generate default TA placement with the desktop application. Ensure that an error message about the invalidity of the XML file is output, and that no XML file about job offerings has been created.

3. **Accepting or Rejecting Instructor TA Modifications**

(a) Accepting a modification

- Ensure that a list of all instructor modifications is present in the *view proposed modifications* page. Select a modification for viewing, and select to accept the modification.
  i. Ensure that the original allocations XML file has been overwritten using the data from the modification XML file that is currently active.

(b) Rejecting a modification

- Ensure that a list of all instructor modifications is present in the *view proposed modifications* page. Select a modification for viewing, and choose to reject the modification.
  i. Ensure that the original allocations XML file has not been modified.
  ii. Ensure that the modifications XML file has been deleted.

4. **Send Job Offers**

(a) Modification XML files present

- Ensure that a TA placement modification XML file is present. Attempt sending job offers in the *view allocation* page.
  i. Ensure that no `offers.xml` file is generated.
  ii. Ensure that an error message informing the user that there are still outstanding modifications is output.

(b) No modification XML files are present

- Remove all modification XML files, and ensure that initial allocation XML file is present. Attempt sending job offers in the *view allocation* page.
  i. Ensure that the `offers.xml` file has been generated with appropriate job offer data corresponding to the TA allocation.

11.2 Instructor Use-Cases

1. **Publish Job Posting**

(a) No course data found

- Remove all course data, or delete the `courses.xml` file. Attempt to open the page containing the *publish job posting* form. Ensure that the page does not open, and an error message informing the user that no courses are available is output.

(b) Course and Instructor data present

- Ensure the presence of the `courses.xml` and `profiles.xml` files, and make sure at least one course is present. Then, open the *publish job posting* form and assert that for the indicated Instructor, all of its courses, and only courses that are being taught by that given professor, are available for selection in the Course list.

(c) Valid input entered, no previous XML file found

- Specify valid information corresponding to a job posting in the *publish job posting* form, and submit the data. Ensure that a XML file called `applications.xml` was generated and contains correct data concerning the job postings that were submitted.

(d) Valid input entered, with previous XML file in place

- With a previously-generated `applications.xml` in place, attempt submitting a job posting using the *publish job posting* form. Ensure that the XML file has been modified such that the new job postings have been appended after the previous ones (therefore, ensure no data was lost).

(e) Type mismatches or empty fields submitted

- Attempt submitting a job posting, leaving fields blank or including type mismatches, such as a non-integral input in the Salary field. Ensure that the `applications.xml` file was not modified (and if it did not previously exist, ensure that it has not been generated).

(f) Valid, but unsound data submitted

- Attempt submitting a job posting with unsound data, such as a start time that is later than an end time.
  i. Ensure that the appropriate error message is output.
  ii. Ensure that the `applications.xml` file was not modified (and if it did not previously exist, ensure that it has not been generated).

2. **Modify initial TA allocation**

(a) No initial allocation data found

- Remove XML file with initial allocation data. Attempt to open TA placement modification page. Ensure that the page does not open, and that an error message informing the user that no allocation has been made is output.

(b) Valid modifications entered

- Enter valid modifications in the modification form, and submit.
  i. Ensure that the initial allocation XML file has not been modified.
  ii. Ensure that a separate XML file containing the data about the modifications has been created appropriately.

(c) Invalid modifications entered

- Enter modifications that have empty fields or type mismatches, for example. Attempt submitting modifications.
  i. Verify that an error message containing the details of the invalidity of the input has been shown.

ii. Ensure that the initial allocation XML file has not been modified.

iii. Ensure that no separate XML files containing modification data have been generated.

3. **Evaluate TA/Grader**

   (a) No student XML data found or no TA's associated to current professor.

   - Remove all student data, or remove job data for a specific professor. Under such professor's account, attempt to open the *evaluate TA* page. Ensure that the page does not open, and that a message informing the user that no TA's are available is output.

   (b) TA data available

   - Open the *evaluate TA* page.
     i. Ensure that only the TA's that worked for courses taught by the selected professor are available for evaluation.
     ii. After submission, ensure that the Student that was evaluated had its `experience` field modified in the `profiles.xml` file.

11.3 Student Use-Cases

1. **Apply to Job Posting**

   (a) No Job data available

   - Remove `applications.xml` file, or ensure that it contains no Job data. Attempt opening the *apply to job posting* page. Ensure that the page does not open and that a message informing the user that Jobs have not been created yet is output.

   (b) Valid input entered

   - Ensure that Job data is available. Open *apply to job posting* page and select a Job to apply to. Ensure that all Jobs that were present in the XML data are available in the selection list. Ensure that after submission, the `applications.xml` file was modified appropriately, and that no data has been lost.

   (c) Invalid input submitted

   - Ensure that Job data is available. Open the *apply to job posting* page and select a Job to apply to. Leave Job field blank, and attempt submitting.
     i. Ensure that an error message informing the user that no Job was selected has been output.
     ii. Ensure that the `applications.xml` file has not been modified.

2. **Submit Personal Details**

   (a) Open *modify profile* page. Ensure that all current data for the current Student is present in the form. Modify data in the forms and submit. Ensure that the *profiles.xml* file has been modified appropriately.

3. **Accept or Reject Job Offerings**

(a) Open the *job offers* page. Ensure that only jobs offered to the current Student are listed. Attempt accepting a job offer and rejecting a job offer. Ensure that the `offers.xml` file has been modified accordingly.

12 Rationale

The system tests that were designed, and their classifications by main actors, were done to provide an organized scheme to verify that all functionalities of the system are covered by the system tests. Given the fact that system tests should be black-box, it only remains to determine if the desired use cases of the system are functioning according to the client's requirements.

To ensure that all requirements are met, the system tests were divided into categories specified by the actor that would use those functionalities. Section **10.1** shows system tests associated with the functionalities that only an Administrator would be responsible for. Then, section **10.2** shows system tests associated with the Instructor's actions. Finally, section **10.3** shows system tests associated with the Student's actions. This categorization made it much simpler to verify that all functionalities were tested, because it allowed functionalities to be listed off as the Use Cases defined in the first Deliverable.

It is important to note that all logic-related bugs concerning the fine details of the calculations carried out by the system should be already covered by the Unit Tests and Integration tests above. Hence, the goal of the System Test plan is to design a routine that tests the communications and interactions between subsystems that were tested in the Integration Tests. Such communications involve mainly the flow of information from the View classes all the way down to the Controller classes that store information about the domain entities in the persistence. All tests described in section **10** verify the proper functioning of the input parsing from the Views, and the output results of the persistence. Once again, everything that happens between the input and the output is in a *black-box*, and it is assumed to have been tested in the previous testing schemes.

Another important thing to consider when designing these System Tests is that the users will not always enter valid inputs, and illegal actions may be attempted. Therefore, testing the ideal inputs only is not a good idea, because it is equally important that the system handles erroneous or invalid input properly as well. To take this into account, each System Test Case was examined, and possible areas of invalid input were found. Each of those invalid input scenarios is accounted for in the System Test plan. Most importantly, it is imperative that submitting erroneous input does not affect the current persistence. Although each test case may experience significantly different errors, if the persistence is not modified under these conditions, the errors will not affect the *bigger picture* of the whole system. Therefore, to complete each test case, any possible invalid inputs are isolated, and it is verified that the persistence is not affected by them.

By carrying out the tests described in section **6**, it is ensured that all Use Cases have been verified, and all bad behavior on the user's end can be handled reliably. Therefore, assuming all tests succeed, it can be confided that all user requirements are functioning properly. As the project continues, new System Tests may be implemented to reflect changes in the user requirements.

13 Coverage Statistics

Given the black-box nature of system testing, the focus should be more on the fact that all branches of logic are tested rather than all statements individually.

Splitting the global actions and logical sequences by platform we have:

- **Desktop (Admin):**
  - Create/Update all Profiles, Jobs and Applications → Tested in section **10.1-3**
  - Publish a job posting as any given Instructor → Tested in section **10.1-2** and **10.1-4**
  - Apply to a job posting as any given Student → Tested in section **10.1-1**
  - View and modify attributes of all available Courses → Tested in section **10.1-1**
  - View, modify, and reject/accept Instructor modifications to the TA allocations → Tested in section **10.1-3**.
- **Web (Instructor):**
  - Create/Publish his own postings → Tested in section **10.2-1**
  - View the attributes to its own available Courses and Profile → Tested in section **10.2-1**.
  - View TA allocation and make modifications → Tested in section **10.2-2**.
  - Send feedback for TA's that worked for their courses → Tested in section **10.2-3**.
- **Mobile (Student):**
  - Apply to the postings available to him → Tested in section **10.3-1**
  - view the attributes to its own available Courses and Profile → Tested in section **10.3-2**

Total number of logical actions: 16
Total number of logical actions tested: 16
Note that the logical actions tested consider the fact that the action was tested on a plethora of edge conditions, such that all alternative workflows are tested. Refer to section **10** to clear any skepticism.

From the thorough enumeration above, it is clear that all use cases of the system (as well as all of their alternative workflows) are examined by the System Test Plan. Therefore, it is expected to have close to 100% test coverage at the system level. Of course, as time passes, there is always the possibility that the client will wish to modify some of the requirements, at which point the System Test Plan, as well as the coverage statistics, may change.

14 Detailed Descriptions of Two Test Cases

The following section will outline two system test cases in such great detail that they could be implemented without the authors' assistance. Due to the omnicapable power of the desktop application, the following two test cases will be described for testing on the desktop.

14.1 The Publish Job Posting Test Case

Setting Up

1. Remove prior XML files. If the system is being run from Eclipse, remove all files in the `output/` directory.
2. Open the main menu
3. Select "Publish Job Posting"
4. **Verify that the Publish Job Posting Window does not appear, but rather an error message saying that no instructors or courses are available is displayed.**

Creating Instructor Profiles

1. Open the main menu
2. Select "Register Profile"
3. Select the Instructor radio button
4. In the First Name field, type "Jim"
5. In the Last Name field, type "Lahey"
6. In the Username field, type "hwn1977"
7. In the Password field, type "pswd"
8. Click "Submit". A confirmation message saying "Instructor hwn1977 was created" should appear, and all fields are reset to blank.
9. Now, for First Name, Last Name, Username, and Password, enter "Randy", "Bobandy", "cheeseburger","pswd2" respectively. Finally, press submit and close the Register Profile window.
10. From the main menu, select "Publish Job Posting".
11. **Verify that the Publish Job Posting Window does not appear, but rather an error message saying that no courses are available is displayed.**

Creating the Courses

1. Open the main menu
2. Select "Create Course"
3. The names "Jim Lahey" and "Randy Bobandy" should now be seen in the list view at the top. Select Jim Lahey.
4. In the Course Name field, type "FACC100 - Trailer Park Supervision"
5. In the CDN field, type "1"

6. In the Grader Time Budget field, enter "19000.0"
7. In the TA Time budget field, enter "14000.0"
8. Click "Create Course". All data in the fields will be cleared.
9. With Jim Lahey still selected, enter the values "ECSE322 - Fixing Lawnmowers", "2", "20000.0,", "15000.0" into the course name, CDN, grader budget, and TA budget fields, respectively. Click submit.
10. Next, select Randy Bobandy from the list at the top of the page.
11. Enter the values "ECSE211 - Dealing with Abuse From an Old Drunk Man", "3", "13","8.75" into the Course Name, CDN, grader budget, and TA budget fields, respectively.
12. Click submit and close the Create Course menu.

At this stage, enough data has been created to test the Publish Job Posting Use Case. The XML files for profiles and courses should already be in the appropriate location.

Publishing a Job Posting

1. Open the main menu, and select "Publish Job Posting"
2. The names Jim Lahey and Randy Bobandy should be in the top-most list view. Select Jim Lahey.
3. **Verify that "FACC100 - Trailer Park Supervision" and "ECSE322 - Fixing Lawnmowers" (and no other courses) appear in the list beneath the instructor names.**
4. Select FACC100 - Trailer Park Supervision. Click "Publish Job".
5. **Verify that an appropriate error message is displayed.**
6. **Verify that, if there is already a `applications.xml` file, there is no mention of an application for Job with the current course name.**
7. Enter "10.5" in the salary field, and "Associate Trailer Park Supervision Experience" in the requirements field. Then, set the end time back by two hours so it is before the start time. Click "Publish Job".
8. **Verify that an appropriate error message is displayed.**
9. **Verify that, if there is already a `applications.xml` file, there is no mention of an Job for the course chosen.**
10. Adjust the end time to be after the start time. Press "Publish Job".
11. **Verify that the `applications.xml` file contains the data for a Job for this chosen course. If other Jobs were posted prior to this one, verify that their corresponding data remains in the XML file.**

12. Chose Randy Bobandy from the top-most list. **Verify that ECSE211 - Dealing with Abuse From an Old Drunk Man is the only option in the list below.**

13. Select the ECSE211 option. Click "Publish Job".

14. Repeat steps 6-11.

14.2 Applying for a Job

Setting up

1. Remove prior XML files. If the system is being run from Eclipse, remove all files in the `output/` directory.

2. Open the main menu

3. Select "Create Job Application"

4. **Verify that the Job Application window does not appear, but rather an error message saying that no jobs or students are available is displayed.**

5. Repeat the *Creating Instructor Profiles* and *Creating Courses* steps from section **13.1**.

6. Repeat steps 2-3.

7. Repeat the *Publishing a Job Posting* steps from section **13.1**, and repeat steps 2-3.

Creating Students

1. Open the main menu. Select "Register Profile"

2. Select the Student radio button.

3. Enter the values "Cosmo", "Kramer", "kman", "pennypacker" into the First Name, Last Name, Username, and Password fields, respectively.

4. Enter "Golfing" in the Skills textbox.

5. Click "Submit". A message saying "Student kman created" should be seen at the top of the window, and all fields should be reset.

6. Enter "George", "Costanza", "vandelay","bosco" into the First Name, Last Name, Username, and Password fields, respectively.

7. Enter "Baseball" in the Skills textbox.

8. Click "Submit". A message saying "Student vandelay created" should be seen at the top of the window. Close the window.

Creating A Job Application

1. From the main menu, select "Create a Job Application". The Job Application window should finally instantiate.

2. Two lists should be present, one containing the student names, and the other containing the job names. In future versions of the system, students will log in and will not need to select their name from a list. For this version, select any student from the list.

3. Without selecting a Job from the list, click "Apply".

4. **Verify that an error message saying that no Job was selected is present, and ensure that the `applications.xml` file has not been modified.**

5. Select a Job from the list. Click "Apply". A friendly message wishing the given student luck for his application to the selected Job will appear.

6. **Verify that the `applications.xml` file has included the job application.**

7. Repeat steps 5 and 6 with different combinations of students and Jobs.

8. **Verify that no data is lost in the `applications.xml` file when multiple applications are created. That is to say, make sure the file has persisted all applications and all courses after multiple applications were submitted.**