Testing Guide For Gurukula Web Application

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Abbreviations

WAR	Web application ARchive
SMTP	Simple Mail Transfer Protocol
HTTP	Hypertext Transfer Protocol
UI	User Interface
API	Application Programming Interface
IDE	Integrated Development Environment
DOM	Document Object Model
UX	User Experience
XSS	Cross Site Scripting

1. Introduction

This document describes the strategy and procedures followed to test the “Gurukula” web application using Selenium and JUnit test frameworks.

2. Experiments

I ran the web application war file (binary delivery from ServiceNow) and tried to create a new account using the user interface. Even though the UI informed that new account creation succeeded, when I tried to login using the credentials of the newly created account, login failed. At this point of time I was unsure if I was doing something wrong with the test environment setup such as not setting up a database etc.

To find out whats going on wrong I put a breakpoint in the JavaScript code (Using Firebug) and got to know that I am getting an error from the server, HTTP error "406 Not Acceptable". To debug this problem the console log (from the application server) was useful to some extent. I tried to setup a MYSQL database without a password and default accounts. Also, I did setup a SMTP server. Initially tried with a real SMTP server but since I was using real email Ids such as bhagyashri.sarbhukan@gmail.com it was not able to send. So, later I switched to a fake smtp server that would not send anything and would just show the mails. However, all these did not help as the activation email was never sent.

The console debug output was already helpful and I got to know that there was some problem with the parsing of the data model for password field. Looked like that the password passed from client side did not seem to adhere to the server side constraints. I already tried a lot with trying out all kinds of passwords and nothing worked.

I never expected it could be an intentionally added bug to be discovered by the test engineer. I to be doubly sure tried to on both a Ubuntu and Windows 7 environment but ended up exact same problem. At this moment I did decide to decompile the WAR file to have a deeper look at whats going on wrong. I consider it unethical to reverse engineer code, in this instance since it was not a production application I thought it would be okay. However, I apologize in case it was not expected from me.

Through decompilation I got to know that indeed the password constraints were set unreasonable (which later I got to know from you that it was intentionally done). It was set to,

```
@JsonIgnore
@NotNull
@Pattern(
        regexp="^(?=[^\\d_].*?\\d)\\w(\\w|[!@#$%]){7,20}"
)
@Size(
        min=60,
        max=60
)
@Column(
        length=60
)
private String password;
```

As we can see the size is min and max both 60, also somehow the regular expression too did not work for me. So, I made a separate project compile this file (along with the dependents) and replaced the compiled class files in the war file. The changes I made are,

```
@JsonIgnore
@NotNull
@Pattern(
        regexp = "^(?=.*[0-9])(?=.*[a-z])(?=.*[A-Z])(?=.*[@#$%^&+=])(?=\\S+$).{8,}$"
)
@Size(
        min = 5,
        max = 60
)
@Column(
        length = 60
)
private String password;
```

To be frank, I copied the regular expression for password from the following link,

http://stackoverflow.com/questions/3802192/regexp-java-for-password-validation

With the patched User.class file and the earlier mentioned fake smtp server, I was able to get the new account creation working. Here is the location of the patched war file,

https://github.com/bsarbhukan/staff/blob/master/gurukula-0.0.1-SNAPSHOT-fix.war

I later informed this and got to know that this was an intentionally added bug.

All the tests those I have written are based on the original WAR file shared. However I have documented all my experiments here as I was asked to do so.

3. Tools Used

Here are the list of tools those were used for enabling automation testing of the “Gurukula” web application,

3.1 Selenium

Selenium webdriver Java APIs were used for automating tests for the “Gurukula” web application.

3.2 Java and JUnit

JUint is a Java based framework designed originally for unit testing but is widely used for both unit and functional testing. Selenium provides Java based WebDriver APIs which makes JUnit as one of the obvious choices for test automation. Specifically Java 8 and JUnit 4.9 was used but the code should run on any version of Java and JUnit.

3.3 Eclipse IDE

Eclipse Java IDE comes with loads of useful features for code completion and refactoring for Java and again one of the most used IDE for Java development. Eclipse also comes bundled with an extremely easy to use JUnit test runner which is again one of reasons to choose Eclipse IDE.

3.4 Maven

Maven is not only a build tool chain but a dependency management tool which makes it easy to manage third party dependencies. Here I am using JUnit and Selenium as third party libraries, using Maven made it much easier to manage these dependencies. Also, Eclipse has a plugin which made it easier to write and manage the pom.xml file (the project definition file for Maven).

3.5 Mercurial and TortoiseHg

For internally developing this I used Mercurial for version control. Mercurial also is a distributed version control system similar to GIT.

3.6 Firebug

Firebug is an addon to Firefox web browser. It is useful for inspecting the DOM tree.

3.7 Selenium IDE

Selenium IDE is a Firefox plugin that was useful for recording during troubleshooting issues.

3.8 Selenium IDE Java Formatters

Selenium IDE Java Formatters is another Firefox plugin useful for identifying XPath for DOM elements.

3.9 M2Eclipse

M2Eclipse is a Eclipse plugin that enables Eclipse to maven projects. This is needed as the test project is based on Maven build system.

3.10 JD GUI

For my experiments to get a new account creation possible with the “Gurukula” web application, I used JD-GUI as the decompilation tool.

4. Design Decisions

There were some design decisions made at the beginning of writing the tests, this chapter explains some of the important design decisions made to make the test code clean and easier to maintain.

4.1 Page Object Model

Page Object is a Design Pattern enhances test maintenance and reduces code duplication. A page object is an object-oriented class that serves as an interface to a page of the web application under tes. The tests then use the methods of this page object class whenever they need to interact with that page of the UI. The benefit is that if the UI changes for the page, the tests themselves don't need to change, only the code within the page object needs to change.

In the context of "Gurukula" this led to much cleaner code. Since, many pages in "Gurukula" could be accessed only after logging in, it was necessary for design using a page object model to reduce code duplication.

4.2 Data Driven Testing

Data-driven testing is creation of test code where test data and output values are located at one location (preferably in a file) instead of using the same hard-coded values each time the test runs. This way, testers can test how the application handles various inputs effectively.

In the context of "Gurukula" the test data is not stored external to the code rather is separated from the tests and is managed inside the code at one location. It uses the JUnit provided Parameterized class and associated annotations to achieve the same. This made passing different kinds of test input parameters to the tests efficiently without any code duplication.

4.3 Browser Factory For Cross Browser Testing

Even though the modern web is based on open standards, it is a reality that different browsers behave differently. So, it is important to execute the same tests with different web browsers. All the tests written for "Gurukula" were executed both on Chrome and Firefox browsers (There are many browsers, since it is not a production application I chose to run it only on two of the most widely used browsers). To enable the cross browsers testing on "Gurukula" the following enablers were used,

1) **JUnit Parameterized Class:** The data driven testing methodology explained earlier made executing same test code executable with different web browsers.

2) **Factory Method Pattern:** A factory method was used for creating the webdriver instance for all browser types. This made is possible to have the tests parameterized on a string to represent the browser.

Some code snippets from the test code,

```
@RunWith(value = Parameterized.class)
public class LoginSuccessTest {
     private String user;
     private String password;
     private String browser;
     LoginPage loginPage;
     WebDriver driver;
     WebDriverWait driverwait;
     @Parameters
     public static Collection testData() {
          return Arrays.asList(
                   new Object[][] {
                            {"admin","admin","chrome"},
                            {"admin","admin","firefox"}
                   }
          );
     }
```

Code Snippet of JUint Parameterized Class

```
public class WebDriverUtils {
     private final static int WEBDIRVER_WAIT_TIME = 30; // In seconds
     public final static int WAIT_TIME = 1000; // In milliseconds
     public final static int MAX_STRESS_LIMIT = 100;
     public static WebDriver getDriver(String browser)
     {
          WebDriver instance = null;
          if(browser.equalsIgnoreCase("chrome"))
          {
               instance = new ChromeDriver();
          }
          else if(browser.equalsIgnoreCase("firefox"))
          {
               instance = new FirefoxDriver();
          }
          return instance;
     }
```

Code Snippet of Factory Class For Driver Creation

4.4 Configuration Separation

Though not many configurations were used, all configurations were separated from the test code in the WebDriverUtils class. For example the web driver wait time can vary from one system to another based on the hardware configurations. I have slow Windows 7 based machine where I had to tweak the time out values to run the tests without any timeouts. Having all the configurations at one place made the maintenance of the tests easy as it can be tweaked from one place.

5. Executing Tests

This section details how the tests can be compiled and executed. The code has been tested to run on Windows 7 and Ubuntu 14.04.

5.1 Software Requirements

The test automation code has been written to run on any environment with the following software configurations,

1) Java 8: Though the code has only been tested with Java 8. It does not use any specific feature and any other version of JDK (Version 6 onwards) could also be used.

2) Selenium: Selenium version 2.46.0 has been used. Any version more recent than 2.0 should be good to use for compilation. However, since Selenium also ships with Firefox webdriver, not using the latest Selenium version, breaks Firefox.

3) JUnit: JUint 4.9 was used for development but any version more recent than 4.0 could be used.

4) Maven: Maven 3.0.5 was used for development.

5.2 Test Environments Used

Because of lack of sufficient time, it has been tested with the following environments only,

1) On 32-bit Windows 7 with Chrome webdrivers installed

2) On Ubuntu based Linux distribution 14.04 with Chrome webdriver

6 Configurations

As mentioned in earlier, I encountered some test failures because of webdriver timeouts when I tried to run the tests on my slow 32-bit Windows 7 machine. I had to tweak the timeouts accordingly. All the configurations are part of the **WebDriverUtils** class, on a smoothly running system I however do not expect any timeouts with the delivered code.

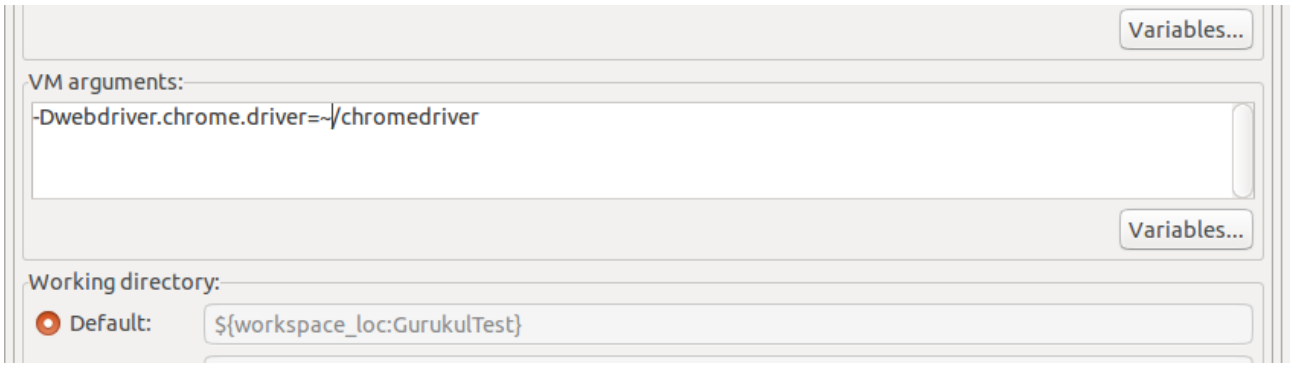
6.1 Executing the tests

In case of Ubuntu I had to install the chrome webdriver separately and to pass the path of the path of the chrome driver as an argument. For Firefox, no setup is needed as it ships with Selenium. The project uses Selenium version 2.46.0. I was using Selenium 2.25.0 earlier and it did not work for Firefox 39. Again, if a older firefox is installed on the test environment, you may need to tweak Selenium version in pom.xml file.

The following are the tested ways for running the tests.

6.1.1 Eclipse IDE

The best way to execute the tests is running it from the Eclipse IDE. The code delivered has the Eclipse project files, so can be imported directly. However, you may need to pass the chrome webdriver as an argument to JVM in case of Ubuntu 14.04.



6.1.2 Command line

The following command can be used to build and run the test application,

Windows 7	mvn clean test
Ubuntu 14.04	mvn clean test -Dwebdriver.chrome.driver=~/chromedriver

7. What was tested?

This section explains the kinds of tests were written and executed for the “Gurukula” web application at a high level.

7.1 Functional Tests

In absence of a formal functional specification, the function of the web application in some cases were implied and some cases was assumed. Examples of tests in this area are for example deletion of a branch should not be allowed if a staff is associated with a branch or the first name of the user could not be complete numeric.

7.2 Data Testing

All the fields were tested for data validation, for example an e-mail id field should allow entries of only valid e-mail Ids. At times there are checks for lengths of entries, such as branch name should not be more than 20 characters, boundary value checks were performed for those.

7.3 SQL Injection

Since the data is stored in an underlying database, it is essential to perform sql injection attacks for all the user entered fields. All user entered fields were tested against entering sql queries. However, this is ensured only in client side, server side could not be tested against it because of unavailability of access to source code.

7.4 XSS

Cross site scripting too is one of the most common vulnerabilities for many existing web application. All the fields were tested against cross site scripting through validating that none of the fields accept Java Script code for input. Again, this is ensured only in client side, server side could not be tested against it because of unavailability of access to source code.

7.4 Stress Testing

Ideally there should be rigorous testing for data persistence in the server side. In the absence of access to the server, some basic stress testing was performed through client side test automation. The tests are implemented in the class `StressTestAddBranchAndStaff` but are disabled using @Ignore JUnit annotation as they take a long time to run. The test tried to add 100 branches and staffs to the database.

8. Issues Found

The following lists the issues discovered with the “Gurukula” web application during testing,

Sr. No.	Summary	Steps	Associated JUnit Test Case Name

1	Multiple entries with the same branch name and code are allowed to be entered to the database. This is not necessarily a bug as the branch Id is different. But, one would expect the “Branch Code” to be the primary key for the table in the database and not another one i.e. “Id” in this case.
	
	Assumption: Duplicate entries should not be allowed in the branch page
		Precondition: Login to URL : http://localhost:8080/#/
		click on login link and enter login name/password as admin/admin and click on Authenticate.
		User should be logged in successfully in Gurukula web application
		Steps to reproduce an issue:
		1.Click on Entities->Branch
		2. Click on “Create a new Branch”
		3.Enter Mathematics in Name field and MATH in Code field
		4. Click on Save button
		5.Repeat step 2,3 and 4 again with the same test data.
		Actual Behavior: In Branch page, you can see duplicate entries with the different ID.
		
		Expected Behavior: Duplicate entries should not be allowed as it is confusing to the end user.
			BranchesTestAddSuccessful.java
			
			`@Test`
			`public void testAdditionOfBranchSuccess()`

2	Multiple entries with the same details (i.e. staff name and branch name pair) are allowed to be entered to the database. This is not necessarily a bug as the staff Id is different. But, one would expect the “Staff name and branch name pair” should be unique to be the primary key for the table in the database and not another one i.e. “Id” in this case.
	
	Assumption: Duplicate entries should not be allowed
		Precondition: Login to URL : http://localhost:8080/#/
		click on login link and enter login name/password as admin/admin and click on Authenticate.
		User should be logged in successfully in Gurukula web application.
		Make sure that below 2 entries are added in branch page:
		Mathematics/MATH
		Physics/PHY
		Steps to reproduce an issue:
		1.Click on Entities->Staff
		2. Click on “Create a new Staff”
		3.Enter Staff Name
		Prof Mathew and select the branch as
			StaffsTestAddSuccessful.java
			
			`@Test`
			`public void testAdditionOfStaffSuccess()`

	in the staff page	Mathematics 4. Click on Save button 5.Repeat step 2,3 and 4 again with the same test data. Actual Behavior: In Staff page, you can see duplicate entries with the different ID. Expected Behavior: Duplicate entries should not be allowed as it is confusing to the end user.	

3	New Account creation is not possible. Explained earlier in the document.
	
	Assumption: New Account creation should be possible once registered with the valid username/email details
		Precondition:NA
		Steps to reproduce an issue:
		1.Go to URL http://localhost:8080/#/
		2.Click on the link "Register a new account"
		3.Enter valid inputs for all the fields:
		Login – bhagyashri
		E-mail- bhagyashri.sarbhukan@gmail.com
		New password- testing
		New password confirmation – testing
		4.Click on the "Register" button
		5. Go to "Home" page and try to login using the same Login and Password used in the Step3
		Actual Behavior: Login and password for the registered user are not accepted and it shows the error note "Registration failed! Please try again later"
		Expected Behavior: User should be able to login to gurukula web application after successful registration is done.
			RegisterNewUserSuccessTest.java
			
			`@Test`
			`public void testNewUserSuccessRegistration()`

4	A staff could be entered without a branch. It is not necessarily a bug. But, something I thought would be good to bring to notice. UX can be improved instead of leaving the field empty. Something like "Branch to be assigned" or "NA"
	
	Assumption:Whenever a new
		Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin.
		Make sure that no branch is added in the Entities → Branch page
		Steps to reproduce an issue:
		1. Go to Entities->Staff page
		2. Click on the button "Create a new staff"
		3. Enter the valid input for Name
			StaffsTestAddWithoutBranch.java
			
			`@Test`
			`public void testAdditionOfStaffWithoutBranch()`

	staff is added when no branch is present. “Branch to be assigned ” or “NA” should be shown in the branch name field instead of empty field. This will not lead to confusion for the users.	field e.g. enter Prof Daniel in the Name field 4. Click on the Branch field , no branch name is available to select 5. Click on “Save” button and check the entry added in the Staff page Actual Behavior: Successful staff name entry is added which doesn't have associated branch. Branch name field is empty which is confusing. Expected Behavior: Logically any college can hire a staff without having a branch name in place. Branch name should have some option to select like “NA” or “Branch to be assigned” while adding a new staff when no branch is present. This will be more user friendly.	

5	In the password change screen, “Save” button is enabled even when the “password” and “confirm password” entries are not same. This is of course handled in the server side, but it should be checked easily on the client side as well to improve UX.
	
	Assumption**:** In Password change screen, “Save” button should not be enabled if input entered in the New Password Confirmation field is not same as in the New Password field.
		Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin.
		Steps to reproduce an issue:
		1.Go to Account->Password
		2.Enter below inputs:
		New password – admin12345
		New password confirmation – canal or canalriver
		3. Observer the “Save” button behavior immediately after entering New password confirmation
		
		Actual Behavior:
		As soon as fifth character is entered in the New password confirmation “Save” button is enabled irrespective of the correct or incorrect entry.
		Expected Behavior:
		“Save” button should not enabled till the exact same entries are entered in the both the fields New password and New password confirmation.
			PasswordChangeFailureTest.java
			
			`@Test`
			`public void testChangePasswordFailure()`

6	Sometimes it was observed that if the HTTP server was killed with Ctrl+C, it did not	This was noticed while running the test cases randomly. Observed while doing exploratory testing of Gurukula	Exploratory Testing (Happens after running tests repeatedly over

	persist the data entered. It could not be automated as I did not have any control over server side but could catch it through some manual testing.	web application.	long time)
7	In Entities → "Branch" page even after deletion of a branch, the "ID" is never taken by a new entry. Again, it is not necessarily a bug. But, something I thought would be good to bring to notice. May be it comes from the database (auto-increment primary key) but looks bad on a user interface. Assumption: In Branch page, ID associated with the deleted branch entry should be used by the system for the future entries.	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Make sure that that you reset the database and there is no entry in the branch page Steps to reproduce an issue: 1. Go to Entities → Branch page 2.Click on the button "Create a new branch" and add below inputs: Name: History Code: HIST 3.Click on Save button 4.Click on the button "Create a new branch" and add below inputs: Name: social science Code: SCI123 5.Click on Save button 6.Click on the button "Create a new branch" and add below inputs: Name: Home Economics Code: HE 7.Click on Save button 8.Observe ID field for all the added entries, it shows ID as 1,2 and 3 for all the above 3 entries added. 9. Delete second entry by clicking "Delete" button associated with the second entry. Actual Behavior: Entry is deleted successfully but ID:2 doesn't get assigned any other future branch entry till the database is erased by doing reset. Expected Behavior: System should reassign ID associated with the deleted branch entry to new branch	Exploratory Testing

		entry to be added in the future.	
8	In Entities-> “Staff” page, even after deletion of a staff, the “ID” is never taken by a new entry. Again, it is not necessarily a bug. But, something I thought would be good to bring to notice. May be it comes from the database (auto-increment primary key) but looks bad on a user interface. Assumption: In Staff page, ID associated with the deleted staff entry should be used by the system for the future staff entries.	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Reset database make sure that below 3 entries are added in branch page: History/HIST Mathematics/MATH Steps to reproduce an issue: 1. Go to Entities → Staff page 2.Click on the button “Create a new Staff” and add below inputs: Name: Mr Daniel Code: History 3.Click on Save button 4.Click on the button “Create a new Staff” and add below inputs: Name: Prof Abha Code: Mathematics 5.Click on Save button 6.Click on the button “Create a new Staff” and add below inputs: Name: Mrs Tiina Code: History 7.Click on Save button 8.Observe ID field for all the added entries, it shows ID as 1,2 and 3 for all the above 3 entries added. 9. Delete second entry by clicking “Delete” button associated with the second entry. Actual Behavior: Entry is deleted successfully but ID:2 doesn't get assigned any other future staff entry till the database is erased by doing reset. Expected Behavior: System should reassign ID associated with the deleted staff entry to new staff entry to be added in the future.	Exploratory Testing
9	In Staff page, first and last	Precondition: Successfully login to	Exploratory Testing

	links get activated though there is only one staff entry is present. Also, the link for the first item get enabled in an empty staff page. Assumption: First, previous, next, Last link should be enabled once maximum branch entries per page are entered and its time to move to the next page.	the URL http://localhost:8080/#/ using login name/password as admin/admin. Make sure that one valid branch History/HIST name/code is added already. Steps to reproduce an issue: 1. Go to Entities → Staff page 2.Click on the button "Create a new staff" and add below inputs: Name: Mr Abhilekh Branch: History 3.Click on Save button 4.Observe at the bottom of the staff page. Actual Behavior: 1.In empty staff page, link for the first item is enabled. 2. As soon as first entry is added in the staff page, link for first and last item is activated. Expected Behavior: Ideally First and last links should be enabled only when more maximum entries per page are entered and user would like to browse the page to toggle the page.	

10	In Entities-> Staff page, search functionality is not working when valid branch name is entered as a search query string.
	
	Assumption: Entries in the staff page is a pair of staff name and its associated branch name. Search functionality should work correctly for any search query string input either valid staff name or branch name.
		Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin.
		Make sure that 2-3 valid branch names and their respective codes are added in the branch page.
		e.g. Branch Names are Mathematics, History
		Steps to reproduce an issue:
		1. Go to Entities → Staff page
		2.Click on the button "Create a new staff" and add below inputs:
		Name: Prof Abha
		Branch: Mathematics
		3.Click on Save button
		4.Click on the button "Create a new staff" and add below inputs:
		Name: Mr. Michel
		Branch: History
			StaffsSearchTest.java
			
			`@Test`
			`public void testStaffSearch()`

		5.Click on Save button 6.Click on the button “Create a new staff” and add below inputs: Name: Mrs Simoe Branch: Mathematics 7.Click on Save button 8.Enter Mathematics as a query string and click on the “Search a Staff” button Actual Behavior: Search result is empty and it doesn't list the staff names' entires associated with the branch as “Mathematics” Expected Behavior: Staff entries should be listed for the Mathematics. and user would like to browse the page to toggle the page.	
11	“Reset forgot password” functionality is not working. Assumption: Registered valid user should be able to reset his/her password if it is forgotten.	Precondition: valid new user is registered successfully to link : http://localhost:8080/#/ Steps to reproduce an issue: 1.Go to url : http://localhost:8080/#/ 2.Click on “login” link 3.Click on “Did you forget your password?” 4. Enter the same valid email address which was used for registering new valid user 5.Click on “Reset password” button Actual Behavior: Link for reactivating password is not sent to the registered email ID. Expected Behavior: Password should be reset by proving the link to reset the password.	Exploratory Testing
12	First, Next, Previous and Last links are absent though branches are added on multiple pages.	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Steps to reproduce an issue: 1. Go to Entities → Branch page 2.Click on the button “Create a new	Exploratory Testing

	Assumption: First, previous, next, Last link should be enabled once maximum staff entries per page are entered and its time to move to the next page.	staff" and add atleast 60-70 entries by entering valid inputs for Branch and Code field. And save all the entries. 3.Observe bottom line of branches page. Actual Behavior: Links for browsing First, Next, Previous and Last items are absent though branches entries are scattered across the multiple pages. Expected Behavior: Links for browsing First, Next, Previous and Last items should be available when branches entries are available on multiple pages.	

13	Complete numeric values are accepted for First Name field in the settings page.
	
	Assumption: First Name cannot have number input as no valid first name has numbers in it. First Name editor should allow to enter only alpha inputs.
		Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin.
		Steps to reproduce an issue:
		1.Go to Account->Settings
		2.Enter only numeric input in First Name
		
		Actual Behavior: It is allowed to enter complete numeric inputs in First Name.
		
		Expected Behavior: First Name field should accept only alpha inputs.
			SettingsTestInvalidInput.java
			
			`@Test`
			`public void testInvalidFistNameChange()`

14	Complete numeric values are accepted for Last Name field in the settings page.
	
	Assumption: Last Name cannot have number input as no valid first name has numbers in it. Last Name editor should allow to enter only alpha inputs.
		Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin.
		Steps to reproduce an issue:
		1.Go to Account->Settings
		2.Enter only numeric input in Last Name
		
		Actual Behavior: It is allowed to enter complete numeric inputs in Last Name.
		
		Expected Behavior: Last Name field should accept only alpha inputs.
			SettingsTestInvalidInput.java
			
			`@Test`
			`public void testInvalidLastNameChange()`

15	Search functionality is not working correctly in the staff page.
	
	Assumption: In Staff page, search result should list of the staff names and their associated branch name. No field should be empty.
		Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin.
		Make sure that you have below branch names and respective codes added in the branch page:
		Mathematics/MATH
		History/HIST1
		Mathematics/101
		Economics/EC
		Make sure that you have below entries added in the staff page:
		prof Abha/<empty branch>
		Mathew/Mathematics
		Mr Daniel/History
		Mathew/Economics
		Albert/Mathematics
		
		Steps to reproduce an issue:
		1.Go to Entities->Staff page
		2.Enter Mathew as a search query string and click on the “Search a Staff” button
		
		Actual Behavior: Two entries having staff name as Mathew are listed but associated branch name field shows empty.
		
		Expected Behavior: Staff search result should show the complete entry i.e. Staff Name and associated Branch name as well.
			StaffsSearchTest.java
			
			`@Test`
			`public void testStaffSearchCheckNonEmptyBranch()`

16	No information note is displayed when user is trying to delete a branch for which staff is assigned.(Its not a major problem at all functionality point of view. System is not allowing to delete a branch for which staff is appointed. So functionality is working correctly. Information note	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Make sure that you have below branch names and respective codes added in the branch page: Mathematics/MATH History/HIST1 Mathematics/101 Economics/EC Make sure that you have below entries added in the staff page:	Exploratory Testing

	can be added for better user experience) Assumption: Information Note should be when user is trying to delete a valid branch which is assigned to a staff in the database.	prof Abha/<empty branch> Mathew/Mathematics Mr Daniel/History Mathew/Economics Steps to reproduce an issue: 1.Go to Entities->Branch page 2.Delete Branch entry Mathematics/MATH by clicking on the "Delete" button associated with this entry. 3.Click on "Delete" button in the Delete confirmation window. Actual Behavior: Entry cannot be deleted as it has associated staff in the staff page (Mathew is associated with Mathematics) Functionality is working correctly. User keeps on clicking on the Delete button but no information note is displayed. Expected Behavior: For better user experience, a small information note can be added like "Branch having staff appointed cannot be deleted"	
17	If a staff is deleted in one server session and is same entry is viewed in another, client views an empty entry. The behavior is fine but the UX can be improved through showing a message rather than a table with empty entries. Assumption: When multiple server session are running. After deleting a staff entry in one session, if user is trying to view the same entry in	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Make sure that you have below branch names and respective codes added in the branch page: Mathematics/MATH History/HIST1 Mathematics/101 Economics/EC Make sure that you have below entries added in the staff page: prof Abha/<empty branch> Mathew/Mathematics Mr Daniel/History Mathew/Economics Steps to reproduce an issue:	Exploratory Testing

	another server session then Staff Name /branch name should not be empty but note can be shown that “This staff is not available”	1. One server session is already running as per precondition 2. Open a new tab and go to URL :http://localhost:8080/#/ 3. In both the server session Go to Entities->Staff page 4.In the first server session, delete one staff entry e.g. Mathew/Mathematics 5.Go to the second server session and click on the View button for the same deleted entry in the step 4 Actual Behavior: In staff view, name and branch shows empty. Functionality is correct but UX can be improved. Expected Behavior: UX can be improved by showing some message instead of showing empty table entries.	
18	If a branch is deleted in one server session and is same entry is viewed in another, client views an empty entry. The behavior is fine but the UX can be improved through showing a message rather than a table with empty entries. Assumption: When multiple server session are running. After deleting a branch entry in one session, if user is trying to view the same entry in another server session then fields should not be empty but note can be shown that “ This Branch is no more	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Make sure that you have below branch names and respective codes added in the branch page: Mathematics/MATH History/HIST1 Mathematics/101 Economics/EC Steps to reproduce an issue: 1. One server session is already running as per precondition 2. Open a new tab and go to URL :http://localhost:8080/#/ 3. In both the server session Go to Entities->Branch page 4.In the first server session, delete one branch entry e.g. Economics/EC 5.Go to the second server session and	Exploratory Testing

	available”	click on the View button for the same deleted entry in the step 4 Actual Behavior: In branch view, branch name and code shows empty. Functionality is correct but UX can be improved. Expected Behavior: UX can be improved by showing some message something like “ This Branch is no more available” instead of showing empty table entries.	
19	If a staff is deleted in one server session and is same entry is edited in another then no action/response by web application. The behavior is fine but the UX can be improved through showing a message rather than just no action. Assumption: When multiple server session are running. After deleting a staff entry in one session, if user is trying to edit the same entry in another server session pop up should be displayed saying that “This staff is not available”	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Make sure that you have below branch names and respective codes added in the branch page: Mathematics/MATH History/HIST1 Mathematics/101 Economics/EC Make sure that you have below entries added in the staff page: prof Abha/<empty branch> Mathew/Mathematics Mr Daniel/History Mathew/Economics Steps to reproduce an issue: 1. One server session is already running as per precondition 2. Open a new tab and go to URL :http://localhost:8080/#/ 3. In both the server session Go to Entities->Staff page 4.In the first server session, delete one staff entry e.g. Mathew/Mathematics 5.Go to the second server session and click on the Edit button for the same deleted entry in the step 4 Actual Behavior: No action after	Exploratory Testing

		clicking on Edit button. Functionality is correct but UX can be improved. Its confusing to the end user. Expected Behavior: UX can be improved by showing some message something like this “This staff is not available” instead of no response.	
20	If a branch is deleted in one server session and is same entry is edited in another, then no action/response by web application. The behavior is fine but the UX can be improved through showing a message rather than no response. Assumption: When multiple server session are running. After deleting a branch entry in one session, if user is trying to edit the same entry in another server session then fields should not be empty but note can be shown that “ This Branch is no more available”	Precondition: Successfully login to the URL http://localhost:8080/#/ using login name/password as admin/admin. Make sure that you have below branch names and respective codes added in the branch page: Mathematics/MATH History/HIST1 Mathematics/101 Economics/EC Steps to reproduce an issue: 1. One server session is already running as per precondition 2. Open a new tab and go to URL :http://localhost:8080/#/ 3. In both the server session Go to Entities->Branch page 4.In the first server session, delete one branch entry e.g. Economics/EC 5.Go to the second server session and click on the Edit button for the same deleted entry in the step 4 Actual Behavior: After clicking on Edit button no action. Functionality is correct but UX can be improved. Expected Behavior: UX can be improved by showing some message something like “ This Branch is no more available” instead of no action. This will not lead user to get confused.	Exploratory Testing