Test Cases and Requirements Test Coverage
NTUCollab: A Collaboratory Platform for NTU Students

Dandapath Soham – Project Manager, Back-end Developer
Gupta Jay – Lead Developer, Release Engineer
Kanodia Ritwik – Front-end Developer, Release Engineer
Mundhra Divyesh – Front-end Developer
Bhatia Ritik – Back-end Developer
Somani Palak – QA Manager, QA Engineer
Bansal Aditya – QA Manager, QA Engineer

Team Eagles
School of Computer Science & Engineering
Nanyang Technological University, Singapore

Version History

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason
1.0	Mundhra Divyesh	26/03/2021	Dandapath Soham	02/04/2021	Initial Test Cases & Requirement Test Coverage Plan
1.2	Gupta Jay	29/03/2021	Dandapath Soham	02/04/2021	Added Unit Tests
1.3	Kanodia Ritwik	02/04/2021	Dandapath Soham	02/04/2021	Added Integration Tests
1.4	Mundhra Divyesh	05/04/2021	Dandapath Soham	08/04/2021	Added System Tests
1.5	Gupta Jay	12/04/2021	Dandapath Soham	16/04/2021	Final Formatting and Summary

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Purpose of Document

A test case is a set of actions performed on a system to determine if it satisfies software requirements and functions correctly. The purpose of test cases written is to determine if different features within NTUCollab are performing as expected and to confirm that the system satisfies all related standards, guidelines and customer requirements. The process of writing the test cases also helps reveal errors or defects within the system.

Test case writing is a major activity and considered as one of the most important parts of software testing. It is used by the testing team, development team as well as the management. Test cases bring together the whole testing process. If the test cases are ready, they are really helpful to measure whether client expectations were fulfilled or not. When we execute test cases, we can get more defects which may be skipped in ad-hoc testing.

Test coverage is defined as a technique which determines whether our test cases are actually covering the application code and how much code is exercised when we run those test cases. Requirements test coverage is used to determine how well the test cases cover the software requirements. Instead of covering each requirement only at the level of the test, we covered all requirements by test configurations. A test configuration represents a specific use-case of a test. Covering test configurations with requirements provided us finer granularity by covering multiple use cases.

This document lists down all the test cases which were formed by our team Eagles to check that our system confers to the product requirements and standards. The tests are divided into 3 major categories which are unit tests, integration tests and system tests. The unit tests were conducted before integration tests which was followed by the system tests at the end.

Unit Testing

The primary purpose of Unit Testing is to test the individual pieces and components of NTUCollab. When the procedures are tested, they are deemed to be fit to use in the application.

Test Case 1

Test Case #	UT1	Test Name	Bottom Navigation
System	NTUCollab	**Sub-System**	Home Page
Designed By	QA Team	**Design Date**	22 March 2021
Executed By	QA Engineer	**Execution Date**	23 March 2021
Description	There are three buttons at the bottom navigation of NTUCollab: Modules, Clubs, and Groups. The user should be redirected to the respective pages when the buttons are tapped.		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account. 3. The user is currently at the Recommended Modules page.

Step #	Action	Expected System Response
1	Tap on the 'Clubs' circular button with the basketball icon at the bottom navigation bar.	The Recommended Clubs page is displayed with the recommended clubs.
2	Tap on the 'Groups' circular button with the group icon at the bottom navigation bar.	The Recommended Groups page is displayed with the recommended interest groups.
3	Tap on the 'Modules' circular button with the book icon at the bottom navigation bar.	The Recommended Modules page is dispayed with the recommended modules.

Post-Conditions	1. The respective pages – Recommended Modules / Clubs / Groups are displayed when tapped using the bottom navigation bar.

Test Case 2

Test Case #	UT2	Test Name	Recommend Slider
System	NTUCollab	**Sub-System**	Home Page
Designed By	QA Team	**Design Date**	22 March 2021
Executed By	QA Engineer	**Execution Date**	23 March 2021
Description	For the three main pages of NTUCollab: Recommended Modules/Clubs/Groups, a slider is shown for the recommendations. The user must be able to swipe left and right in the slider to see all the recommended options.		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account. 3. The user is currently at the Recommended Modules page.

Step #	Action	Expected System Response
1	Swipe left two times on the Recommended options using a single finger gesture.	The recommended options change with each swipe and the options shown are unique.
2	Swipe right two times on the Recommended options using a single finger gesture.	The recommended options change with each swipe and the options shown are unique.

Post-Conditions	1. The recommended options shown change when they are swiped left and right in the slider of all the 3 pages mentioned above.

Test Case 3

Test Case #	UT3	Test Name	Selection of Tags
System	NTUCollab	**Sub-System**	Home Page
Designed By	QA Team	**Design Date**	22 March 2021
Executed By	QA Engineer	**Execution Date**	23 March 2021
Description	When the user logs in to the application for the first time, NTUCollab must prompt them to select the suitable tags for modules, clubs, and interest groups.		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account. 3. The user is logging in for the first time or they had not selected any tags in the previous login. 4. The user is currently at the Select Tags page for modules.

Step #	Action	Expected System Response
1	Tap on the 'Next →' button.	The Select Tags page for clubs is displayed.
2	Tap on the 'Next →' button.	The Select Tags page for Interest Groups is displayed.
3	Tap on the 'Next →' button.	The home page of NTUCollab is displayed.

Post-Conditions	1. The home page of NTUCollab is displayed after the selection of tags of all three types: Modules, Clubs, and Interest Groups.

Test Case 4

Test Case #	UT4	Test Name	Rating Buttons
System	NTUCollab	Sub-System	Group Detail Page
Designed By	QA Team	Design Date	22 March 2021
Executed By	QA Engineer	Execution Date	23 March 2021
Description	When the user taps on any type of group card, a detail page is displayed where they can see more information about the group. In the detail page, they application must allow to rate the group out of 5 in all three categories which differ by the type of group selected.		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account. 3. The user is currently at a Group Detail page.

Step #	Action	Expected System Response
1	Tap on the 'Rate' rounded button.	A Rating dialog box is displayed with 3 different options to rate.
2	Select 3 Stars in the first rating criteria.	3 stars out of 5 are highlighted with Yellow color.
3	Select 5 Stars in the second rating criteria.	5 stars out of 5 are highlighted with Yellow color.
4	Select 0 Stars in the third rating criteria.	No stars are highlighted, all of them remain hollow.

Post-Conditions	1. In the Rating dialog box, the different criterions are highlighted according to the rating selected.

Test Case 5 (White Box Testing)

Test Case #	UT5	Test Name	Data Mapping
System	NTUCollab	Sub-System	Group Detail Page
Designed By	QA Team	Design Date	22 March 2021
Executed By	QA Engineer	Execution Date	23 March 2021
Description	When the user taps on any type of group card, a detail page is displayed where they can see more information about the group. The detail page is populated by the information supplied from the home page.		

Pre-Conditions	N/A

Step #	Action	Expected System Response
1	Call implemented test method testModuleDataTransfer(arg1 = dummyData, arg2 = ModuleDetailPage)	All the data should be populated to keys of the Module Detail Page. With all the keys matching, Boolean value true is returned.
2	Call implemented test method testClubDataTransfer(arg1 = dummyData, arg2 = ClubDetailPage)	All the data should be populated to keys of the Club Detail Page. With all the keys matching, Boolean value true is returned.
3	Call implemented test method testGroupDataTransfer(arg1 = dummyData, arg2 = GroupDetailPage)	All the data should be populated to keys of the Interest Group Detail Page. With all the keys matching, Boolean value true is returned.

Post-Conditions	1. All the three test method calls return a Boolean true value upon execution to indicate that all the data keys are matching.

Integration Testing

An incremental top-down approach has been used to conduct integration tests on NTUCollab. This ensures that usability is not compromised for edge cases and when the use case involves long sequence of actions.

Test Case 1

Test Case #	IT1	Test Name	Authentication
System	NTUCollab	Sub-System	Authentication
Designed By	QA Team	Design Date	25 March 2021
Executed By	QA Engineer	Execution Date	26 March 2021
Description	The user must be able to login into the system using their credentials upon verification by Firebase Auth		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection.

Step #	Action	Expected System Response
1	Sign in with google/Register with email and password	A pop up is shown to select the google account to sign in with/Text box to enter email and password for registering
2	User selects the google account/Enters email and password	The user is registered and taken to the next screen. The user credentials are reflected in the 'Authentication' tab of firebase dashboard. A document with the user's unique id is also created and added to the 'users' collection in the database to store user related data.

Post-Conditions	The user is in the tag selection page which follows the registrations page.

Test Case 2

Test Case #	IT2	Test Name	Tag Selection
System	NTUCollab	**Sub-System**	Tag Selection
Designed By	QA Team	**Design Date**	26 March 2021
Executed By	QA Engineer	**Execution Date**	27 March 2021
Description	The user must be able to login into the system and select the tags for the three main components		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be registered in to NTUCollab.

Step #	Action	Expected System Response
1	Sign in with google/Login with email and password	User is in the Module Tag selection page
2	User selects interest tags for modules	The interest tags are stored inside a list named modules which in turn is stored in the firestore database inside the user's document. The user is taken to the Club tag selection page.
3	User selects interest tags for clubs	The interest tags are stored inside a list named clubs which in turn is stored in the firestore database inside the user's document. The user is taken to the Interest tag selection page.
4	User selects interest tags for interest groups	The interest tags are stored inside a list named interests which in turn is stored in the firestore database inside the user's document.

Post-Conditions	The user is in the module recommendations page.

Test Case 3

Test Case #	IT3	Test Name	Recommendations
System	NTUCollab	**Sub-System**	Recommendations
Designed By	QA Team	**Design Date**	27 March 2021
Executed By	QA Engineer	**Execution Date**	28 March 2021
Description	The user must be able to login into the system, select tags, and see the recommendations for the three respective components.		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be registered in to NTUCollab.

Step #	Action	Expected System Response
1	Sign in with google/Login with email and password	User is in the Module Tag selection page
2	User selects the tags for the three components namely Modules, Clubs and Interest groups.	The user is directed to the module recommendation page. The tags selected by the user for modules is fetched from the user's document in the database. The tags for each of the modules is fetched from their respective documents in the 'modules' collection. Top 5 modules are filtered based on a tag matching algorithm. The 5 modules are shown as the recommended modules along with all other data fetched from their respective documents.
3	User navigates to Club recommendations	The user is directed to the club's recommendation page. A similar process is used to recommend and display clubs.

4	User navigates to Interest group recommendations.	The user is directed to the interest group's recommendation page. A similar process is used to recommend and display interest groups.

Post-Conditions	The user is in the interest groups recommendations page.

Test Case 4

Test Case #	IT4	Test Name	Groups
System	NTUCollab	Sub-System	Groups
Designed By	QA Team	Design Date	28 March 2021
Executed By	QA Engineer	Execution Date	29 April 2021
Description	The user must be able to login into the system, select the tags for the three main components, get recommendations and see description, rate and make posts on the recommended groups. The user must also be able to able to see other groups which were not recommended.		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be registered in to NTUCollab.

Step #	Action	Expected System Response
1	Sign in with google/Login with email and password	User is in the Module Tag selection page
2	User selects the tags for the three components namely Modules, Clubs and Interest groups.	The user is directed to the module recommendation page.
3	User selects one of the recommended modules.	A pop up is shown with description of the module, its ratings and posts made by other users.

4	User rates the module.	The updated rating is calculated and stored in the data base in the module's document. The updated rating is also reflected on the UI.
5	User makes a post about the module.	The post content and other details is stored in the module's document. The post is also reflected on the UI.
6	User closes the pop up and taps on 'Show other modules' button	All the other modules which were not recommended, each behaving in the same above-mentioned manner, are displayed.
7.	User navigates to the Club recommendations and repeats 3-6.	Similar behavior is expected as modules but for clubs.
8.	User navigates to the Interest groups recommendations and repeats 3-6.	Similar behavior is expected as modules but for Interest groups.

Post-Conditions	The user is in the Interest groups recommendations page where all the interest groups are displayed.

Test Case 5

Test Case #	IT5	Test Name	Create interest groups
System	NTUCollab	**Sub-System**	Create Groups
Designed By	QA Team	**Design Date**	29 March 2021
Executed By	QA Engineer	**Execution Date**	30 April 2021
Description	The user must be able to login into the system, select the tags for the three main components, get recommendations. The user must be able to create interest groups		

Pre-Conditions	1. The mobile device must be connected to a stable internet connection. 2. The user must be registered in to NTUCollab.

Step #	Action	Expected System Response
1	Sign in with google/Login with email and password	User is in the Module Tag selection page
2	User selects the tags for the three components namely Modules, Clubs and Interest groups.	The user is directed to the module recommendation page.
3.	User navigates to the Interest groups recommendations and taps on 'Create interest group' Button	A pop is shown where the user has to type the name of the interest group, select tags which best define the interest group and invite members to this interest group. These information are captured and stored in a new document for the interest group which in turn is stored in the 'Interest Groups' collection in the database.

Post-Conditions	The user is in the interest group recommendations page with the newly created interest group.

System Testing

System testing is the process of testing all the integrated hardware and software components of our system to verify that the application meets its specified requirements.

Test Case 1

Test Case #	ST1	Test Name	Smoke testing
System	NTUCollab	Sub-System	Smoke testing
Designed By	QA Team	Design Date	6 April 2021
Executed By	QA Engineer	Execution Date	7 April 2021
Description	The user must be able to login to the application and be able to navigate across and use all the features designed.		

Pre-Conditions	1) The user must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account. 2) The mobile device must be connected to a stable internet connection.

Step #	Action	Expected System Response
1	Selection of Tags	Visual display of tags selected is shown and the same is updated in the database.
2	View Recommended Groups	The user can view a list and details of the recommended groups under the 3 sections which are Clubs, Modules and Interest Groups.
3	User can create a new group.	A new group is created and updated in our database with the associated members and tags.
4	User can rate groups, like and comment on posts as well as create them.	The visual display of a post or ratings of groups are updated along with being updated in our database.

Post-Conditions	The complete system is able to interact based on user's action.

Test Case 2

Test Case #	ST2	Test Name	Installation Testing
System	NTUCollab	**Sub-System**	Installation Testing
Designed By	QA Team	**Design Date**	6 April 2021
Executed By	QA Engineer	**Execution Date**	7 April 2021
Description	The user must be able to install application on their mobile device.		

Pre-Conditions	1) The user must have a mobile device. 2) The mobile device must be connected to a stable internet connection.

Step #	Action	Expected System Response
1	Installation of application	Irrespective of the mobile platform being iOS or android, the application must be able to install.

Post-Conditions	The application is successfully installed and ready to use on any mobile device.

Test Case 3

Test Case #	ST3	Test Name	Stress Testing
System	NTUCollab	Sub-System	Stress Testing
Designed By	QA Team	Design Date	6 April 2021
Executed By	QA Engineer	Execution Date	7 April 2021
Description	Multiple users must be able to use the application simultaneously.		

Pre-Conditions	1) The mobile devices must be connected to a stable internet connection. 2) The users must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account.

Step #	Action	Expected System Response
1	115 users are operating the application simultaneously.	The application should work smoothly without crashing. The users should be able to navigate across pages and be able to use all the features of NTUCollab.

Post-Conditions	The application is operated by 115 users simultaneously.

Test Case 4

Test Case #	ST4	Test Name	Scalability Testing using Database
System	NTUCollab	**Sub-System**	Scalability Testing using Database
Designed By	QA Team	**Design Date**	6 April 2021
Executed By	QA Engineer	**Execution Date**	7 April 2021
Description	Database should be able to process queries from multiple application without crashing.		

Pre-Conditions	1) The mobile devices must be connected to a stable internet connection. 2) The users must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account.

Step #	Action	Expected System Response
1	115 users are operating the application simultaneously. The users must select or edit their interest tags.	The database should update the selected tags for all the users simultaneously and process these tags to show the recommended groups. The update to Firebase should be smooth and the server should not crash.

Post-Conditions	The database is updated based on the application usage of 115 users simultaneously.

Test Case 5

Test Case #	ST5	Test Name	Recoverability Testing
System	NTUCollab	**Sub-System**	Recoverability Testing
Designed By	QA Team	**Design Date**	6 April 2021
Executed By	QA Engineer	**Execution Date**	7 April 2021
Description	The data stored for any user must be stored in the database if the app crashes or the device loses internet connectivity.		

Pre-Conditions	1) The mobile devices must be connected to a stable internet connection. 2) The users must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account.

Step #	Action	Expected System Response
1	The user changes the selected tags via the 'Profile' option. The OS kernel library is deleted supporting NTUCollab, due to which, the application crashes.	The database must contain the data for the user operating the application. The system must update the database at small intervals of time which prevents loss of data in case the application crashes.

Post-Conditions	The application is able to recover the data of the user in case the app crashes while its operation.

Test Case 6

Test Case #	ST6	Test Name	Security Testing
System	NTUCollab	Sub-System	Security Testing
Designed By	QA Team	Design Date	6 April 2021
Executed By	QA Engineer	Execution Date	7 April 2021
Description	Any user must not be able to login in an unauthorized manner or manipulate NTUCollab's database.		

Pre-Conditions	1) The mobile devices must be connected to a stable internet connection. 2) The users must be logged in to NTUCollab via the NTU Single-Sign-On (SSO) method or their Google account.

Step #	Action	Expected System Response
1	A script is written which tries to bypass NTUCollab's security firewall and manipulate the database.	The user must not be able to login through the script and must be redirected to the home page. If the user is already logged in, the user must be shown a warning and be logged out of the application.

Post-Conditions	The application is able to protect the database from any unauthorized intrusion or security breaches.

Summary

Test Case	Test Data	Expected Result	Actual Result	Status
UT1	N/A (UI Flow Testing)	Recommended Modules / Clubs / Groups pages are displayed when tapped using the bottom navigation bar.	Recommended Modules / Clubs / Groups pages are displayed when tapped using the bottom navigation bar.	Pass
UT2	N/A (UI Flow Testing)	The recommended options shown change when they are swiped left and right in the slider of all the 3 pages mentioned.	The recommended options shown change when they are swiped left and right in the slider of all the 3 pages mentioned.	Pass
UT3	N/A (UI Flow Testing)	The user is prompted to select the 3 types of tags, and the home page is displayed.	The user is prompted to select the 3 types of tags, and the home page is displayed.	Pass
UT4	N/A (UI Flow Testing)	In the Rating dialog box, the different criterions are highlighted according to the rating selected.	In the Rating dialog box, the different criterions are highlighted according to the rating selected.	Pass
UT5	Dummy Module / Clubs / Interest Groups Data	All the three test method calls return a Boolean true value upon execution to indicate that all the data keys are matching.	All the three test method calls return a Boolean true value upon execution to indicate that all the data keys are matching.	Pass
IT1	User Credentials	User must be logged into the system.	User is logged into the system.	Pass
IT2	User Tags	User must be able to select the three types of tags after logging in.	User is able to select the three types of tags after logging in.	Pass

IT3	User Tags	User must be able to login, select tags and see recommendations for the three main components	User is able to login, select tags and see recommendations for the three main components	Pass
IT4	User tags and group info.	User must be able to see the groups details and other groups which were not recommended post login and recommendation.	User is able to see the groups details and other groups which were not recommended post login and recommendation.	Pass
IT5	User tags, group info and new group details.	User must be able create interest groups post login and recommendation	User is able create interest groups post login and recommendation	Pass
ST1	Smoke Test	A user must be able to login to the application and be able to navigate across and use all the features designed.	User is able to login to the application and be able to navigate across and use all the features designed.	Pass
ST2	Installation Test	Users must be able to install application on their mobile device.	Users are able to install application on their mobile device.	Pass
ST3	Stress Test	Multiple users must be able to use the application simultaneously.	Multiple users are able to use the application simultaneously.	Pass
ST4	Scalability Test	Database must be able to process queries from multiple application without crashing.	Database is able to process queries from multiple application without crashing.	Pass
ST5	Recoverability Test	The data stored for any user must be stored in the database if the app crashes or the device loses internet connectivity.	The data is stored for a user in the database, even if the app crashes or the device loses internet connectivity.	Pass

ST6	Security Test	A user must not be able to login in an unauthorized manner or manipulate NTUCollab's database.	User is not be able to login in an unauthorized manner or manipulate NTUCollab's database.	Pass