

CS ModBuddy - Developer Guide

1. Setting up	2
2. Design	2
2.1. Architecture	2
2.2. UI component	5
2.3. Logic component	5
2.4. Model component	6
2.5. Storage component	8
2.6. Common classes	9
3. Implementation	9
3.1. Undo/Redo feature	9
3.2. Parser	13
3.3. Version Tracking	14
3.4. Logging	18
3.5. Configuration	18
3.6. Tagging Feature	18
3.7. Module Information and Verification	23
3.8. Autocomplete	27
4. Documentation	30
5. Testing	30
6. Dev Ops	31
Appendix A: Product Scope	31
Appendix B: User Stories	31
Appendix C: Use Cases	36
C.1. Use case: UC01 - Create study plan	36
C.2. Use case: UC02 - Add module	37
C.3. Use case: UC04 - Tag a module	38
C.4. Use case: UC05 - Correct modules without a prerequisite	38
C.5. Use case: UC06 - Chaining commands	39
Appendix D: Non Functional Requirements	39
Appendix E: Glossary	40
Appendix F: Instructions for Manual Testing	44
F.1. Launch and Shutdown	45
F.2. Executing basic commands	45
F.3. Executing module-related commands	46
F.4. Executing semester-related commands	46
F.5. Executing tagging-related commands	48
F.6. Executing study plan-level commands	49
F.7. Executing version tracking-related commands	51

F.8. Executing information and verification-related commands	52
F.9. Executing GUI-related commands	53



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1. Setting up

Refer to the guide [here](#).

2. Design

2.1. Architecture

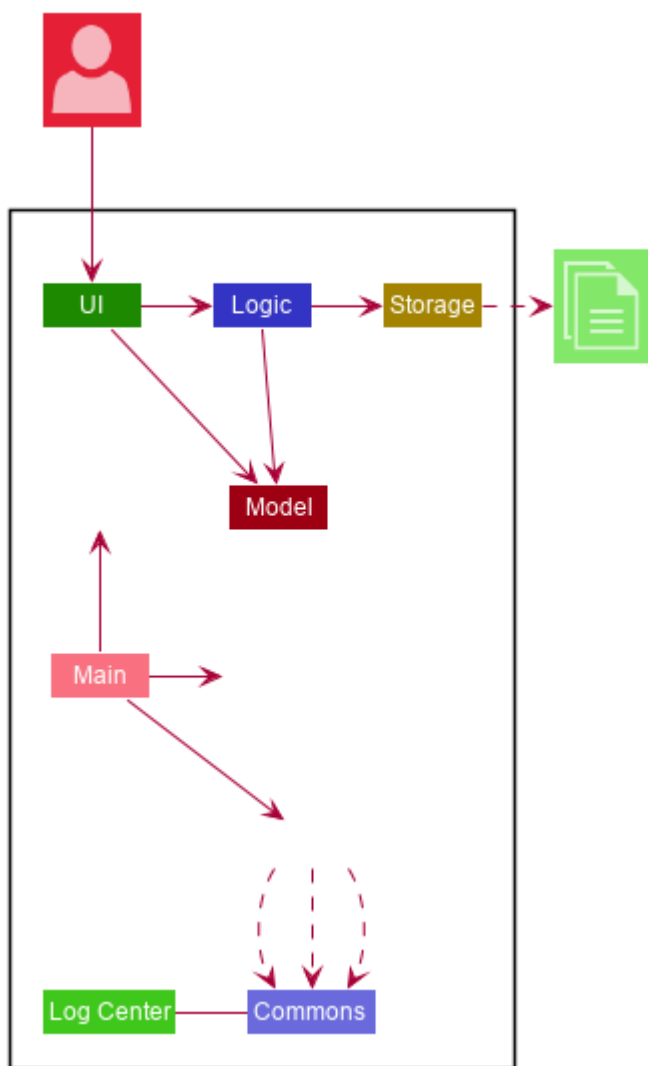


Figure 1. Architecture Diagram

The **Architecture Diagram** given above explains the high-level design of the App. Given below is a quick overview of each component.

Main has two classes called **Main** and **MainApp**. It is responsible for,

- At app launch: Initializes the components in the correct sequence, and connects them up with each other.
- At shut down: Shuts down the components and invokes cleanup method where necessary.

Commons represents a collection of classes used by multiple other components. The following class plays an important role at the architecture level:

- **LogsCenter** : Used by many classes to write log messages to the App's log file.

The rest of the App consists of four components.

- **UI**: The UI of the App.
- **Logic**: The command executor.
- **Model**: Holds the data of the App in-memory.
- **Storage**: Reads data from, and writes data to, the hard disk.

Each of the four components

- Defines its *API* in an **interface** with the same name as the Component.
- Exposes its functionality using a **{Component Name}Manager** class.

For example, the **Logic** component (see the class diagram given below) defines its API in the **Logic.java** interface and exposes its functionality using the **LogicManager.java** class.

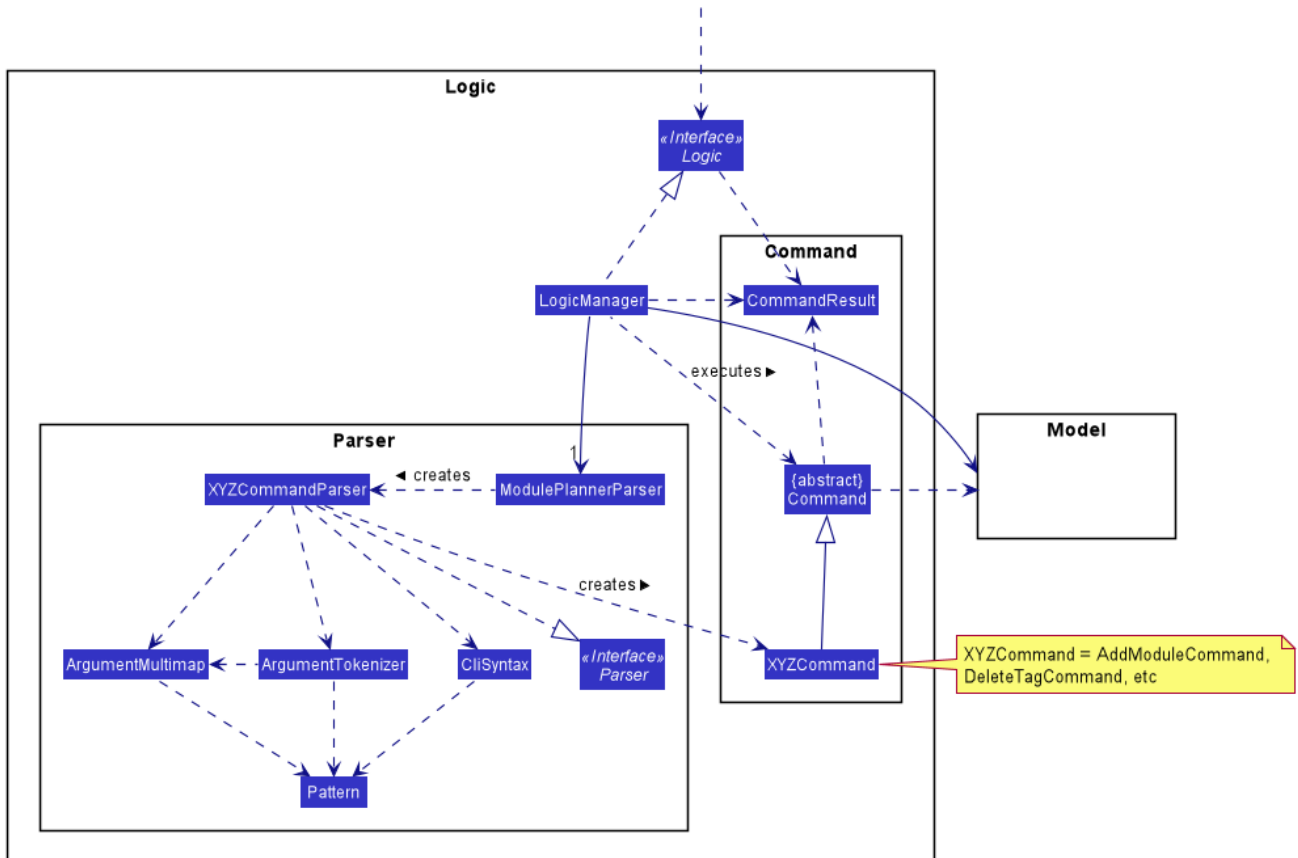


Figure 2. Class Diagram of the Logic Component

How the architecture components interact with each other

The *Sequence Diagram* below shows how the components interact with each other for the scenario where the user issues the command `addmod y1s1 CS3244`.

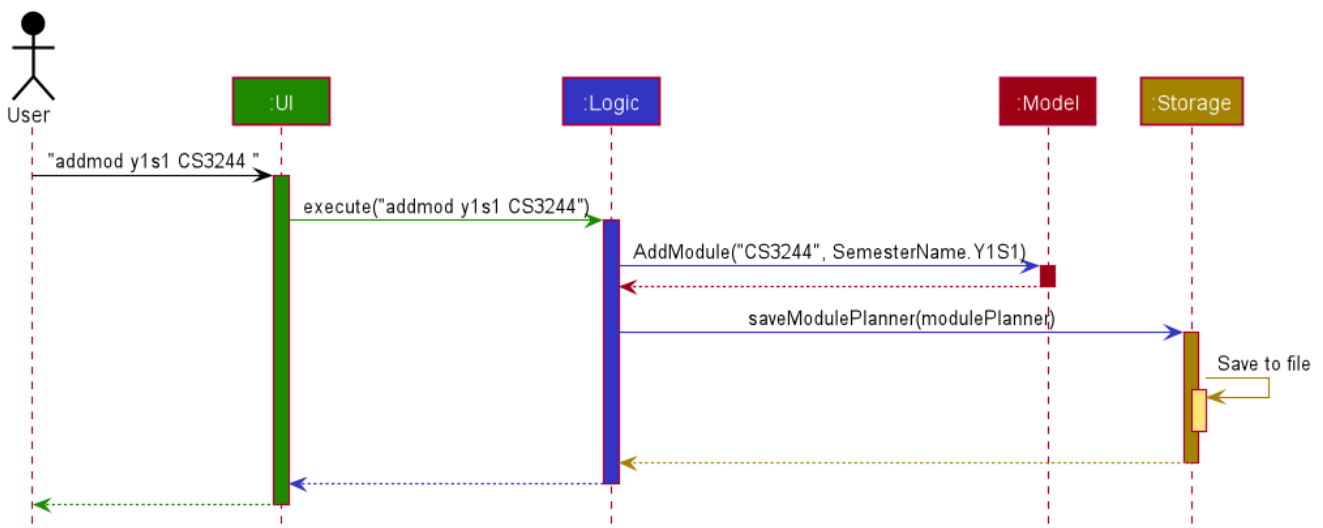


Figure 3. Component interactions for the `addmod y1s1 CS3244` command

The sections below give more details of each component.

2.2. UI component

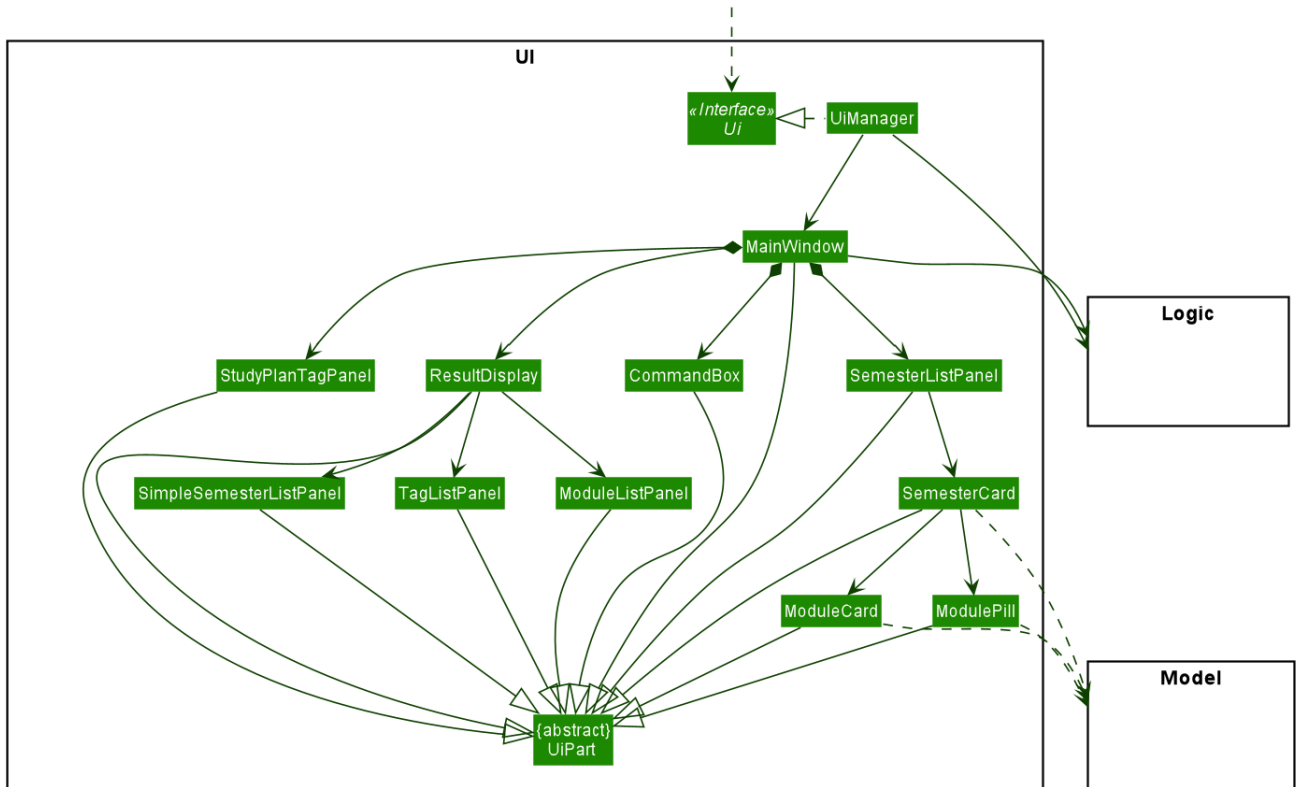


Figure 4. Structure of the UI Component

API: `Ui.java`

The UI consists of a `MainWindow` that is made up of parts e.g. `SemesterListPanel`, `ResultDisplay`, `CommandBox`, `StudyPlanTagPanel`, etc. All these, including the `MainWindow`, inherit from the abstract `UiPart` class.

The UI component uses JavaFx UI framework. The layout of these UI parts are defined in matching `.fxml` files that are in the `src/main/resources/view` folder. For example, the layout of the `MainWindow` is specified in `MainWindow.fxml`

The UI component,

- Executes user commands using the `Logic` component.
- Listens for changes to `Model` data so that the UI can be updated with the modified data.

2.3. Logic component

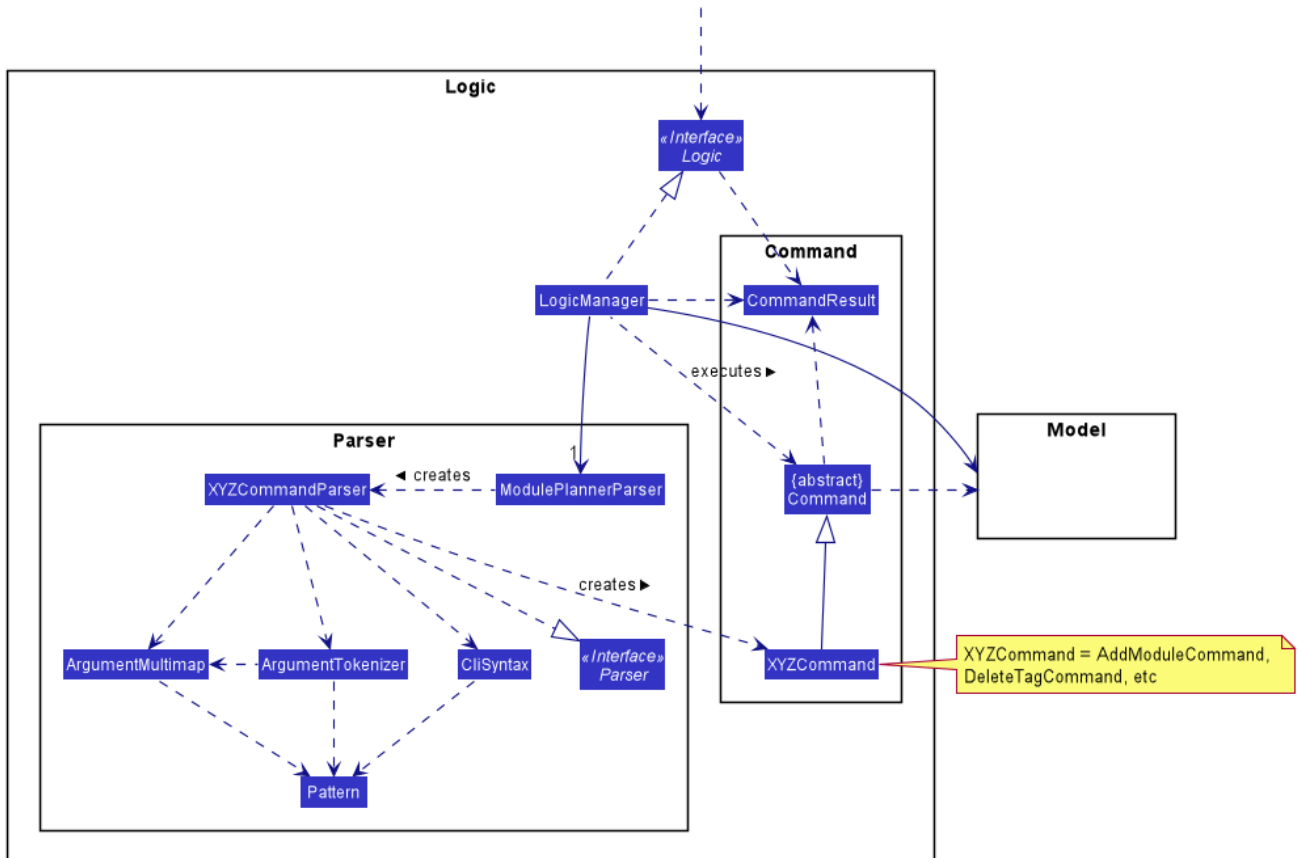


Figure 5. Structure of the Logic Component

API: `Logic.java`

1. `Logic` uses the `modulePlannerParser` class to parse the user command.
2. This results in a `Command` object which is executed by the `LogicManager`.
3. The command execution can affect the `Model` (e.g. adding a module).
4. The result of the command execution is encapsulated as a `CommandResult` object which is passed back to the `Ui`.
5. In addition, the `CommandResult` object can also instruct the `Ui` to perform certain actions, such as displaying information to the user or refreshing the `Ui`.

2.4. Model component

- stores a **UserPref** object that represents the user's preferences.
- stores the data in the module planner, which consists of module information, study plans, semesters, modules, tags and version tracking history.
- exposes an unmodifiable **ObservableList<StudyPlan>** that can be 'observed' e.g. the UI can be bound to this list so that the UI automatically updates when the data in the list change.
- does not depend on any of the other three components.

2.5. Storage component

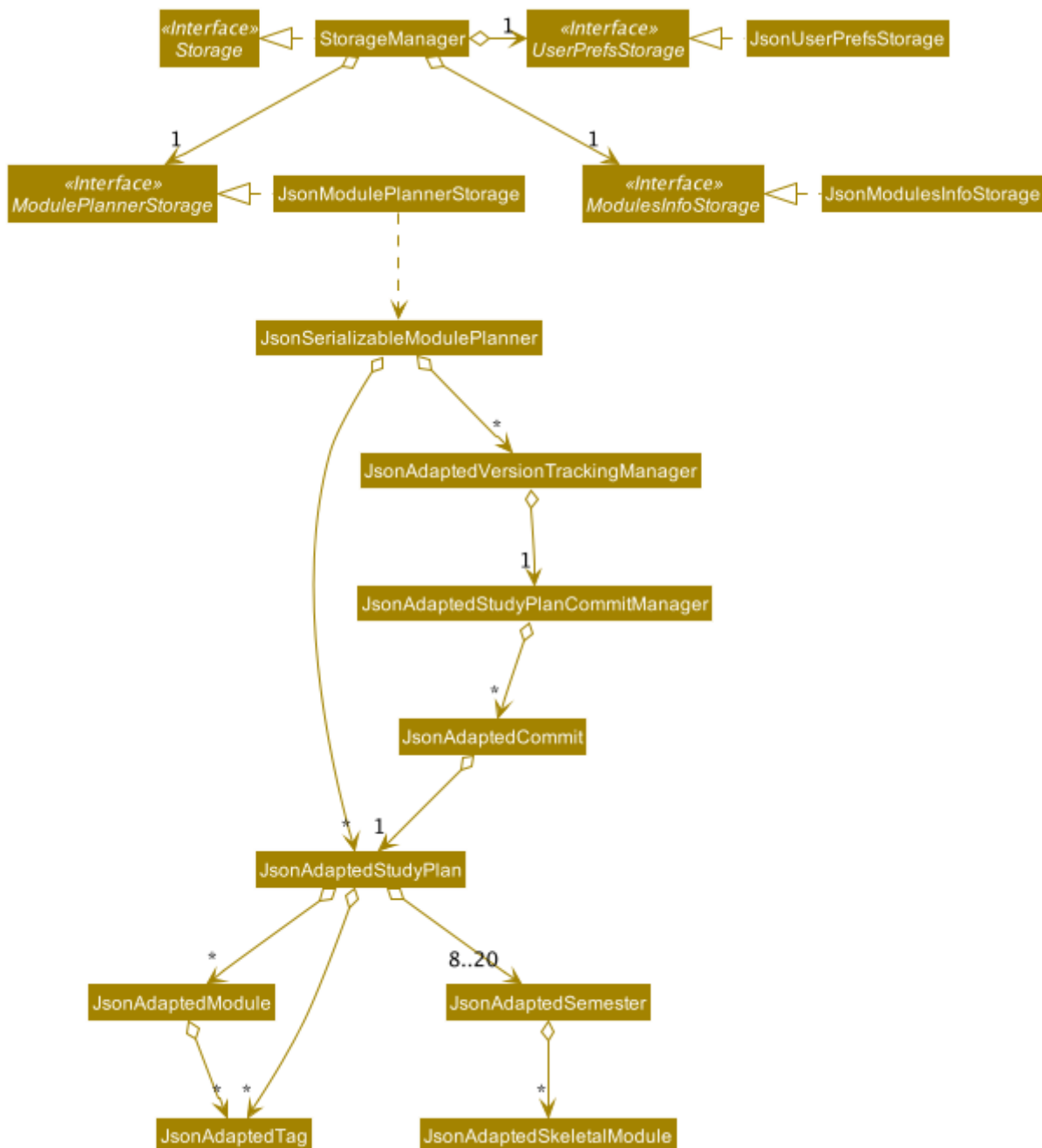


Figure 7. Structure of the Storage Component

API : **Storage.java**

The **Storage** component,

- can save `UserPref` objects in json format and read it back.
- can save the `ModulePlanner` data in json format and read it back.
- can save the `ModulesInfo` data in json format and read it back.

2.6. Common classes

Classes used by multiple components are in the `seedu.address.common` package.

3. Implementation

This section describes some noteworthy details on how certain features are implemented.

3.1. Undo/Redo feature

3.1.1. Current Implementation

The undo/redo mechanism is inspired by the undo/redo implementation in AddressBook 3 and is facilitated by `VersionedModulePlanner`. It extends `modulePlanner` with an undo/redo history, stored internally as an `historyStateList` and `currentStatePointer`. Additionally, it implements the following operations:

- `VersionedModulePlanner#commit()` — Saves the current module planner state in its history.
- `VersionedModulePlanner#undo()` — Restores the previous module planner state from its history.
- `VersionedModulePlanner#redo()` — Restores a previously undone module planner state from its history.

These operations are exposed in the `Model` interface as `Model#addToHistory()`, `Model#undo()` and `Model#redo()` respectively.

NOTE

Currently, the undo-redo mechanism does not include/respond to changes to commands involving Commits - saving and removing changes to the storage files.

Given below is an example usage scenario and how the undo/redo mechanism behaves at each step.

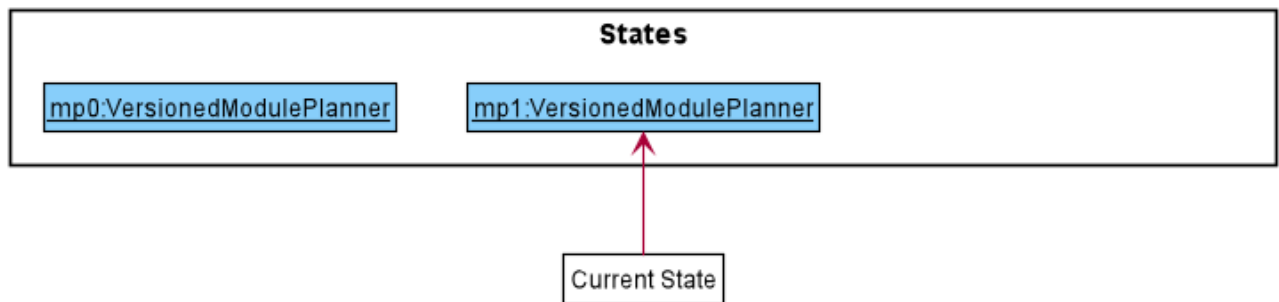
Step 1. The user launches the application for the first time. The `VersionedModulePlanner` will be initialized with the initial module planner state, and the `currentStatePointer` pointing to that single module planner state.

Initial state



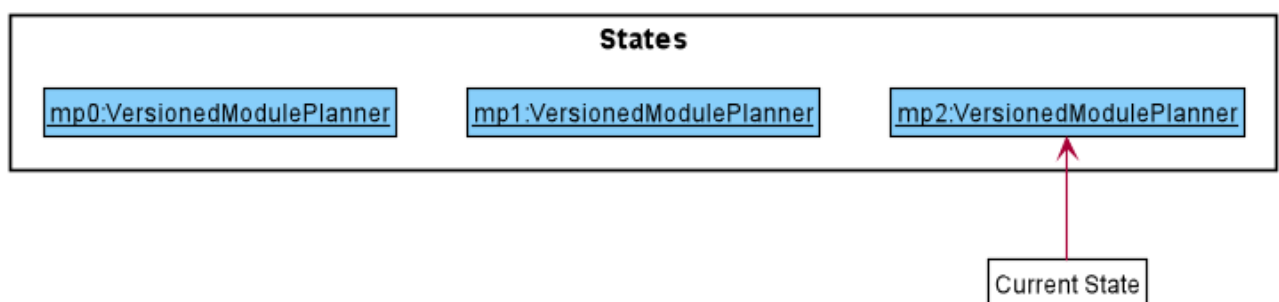
Step 2. The user executes `addmod CS3233 y1s1` command to add the Module `CS3233` module into Semester `y1s1` in the active study plan. The `addmod` command calls `Model#addToHistory()`, causing the modified state of the module planner after the `addmod CS3233 y1s1` command executes to be saved in the `historyStateList`, and the `currentStatePointer` is shifted to the newly inserted module planner state.

After command "addmod CS3233 y1s1"



Step 3. The user executes `removemod CS1101s y1s1` to remove the Module `CS1101S` module from Semester `y1s1` in the active study plan. The `remove` command also calls `Model#addToHistory()`, causing another modified module planner state to be saved into the `historyStateList`.

After command "removemod CS1101s y1s1"



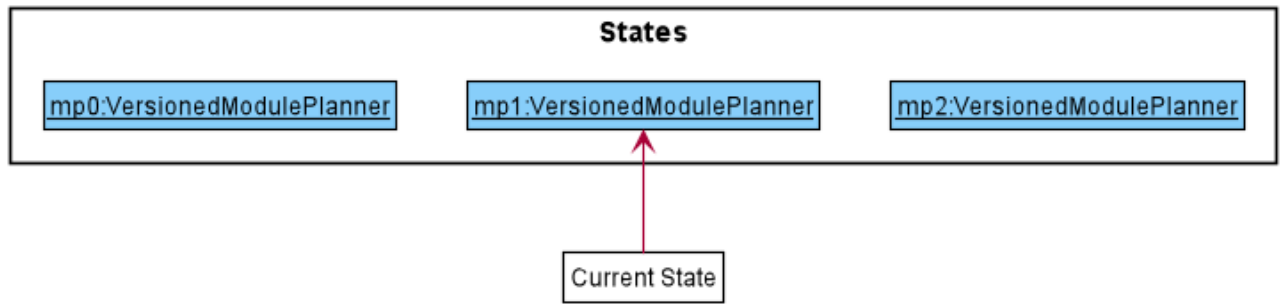
NOTE

If a command fails its execution, it will not call `Model#addToHistory()`, so the module planner state will not be saved into the `historyStateList`.

Step 4. The user now decides that removing the module was a mistake, and decides to undo that action by executing the `undo` command. The `undo` command will call `Model#undo()`, which will shift the `currentStatePointer` once to the left, pointing it to the previous module planner state, and

restores the module planner to that state.

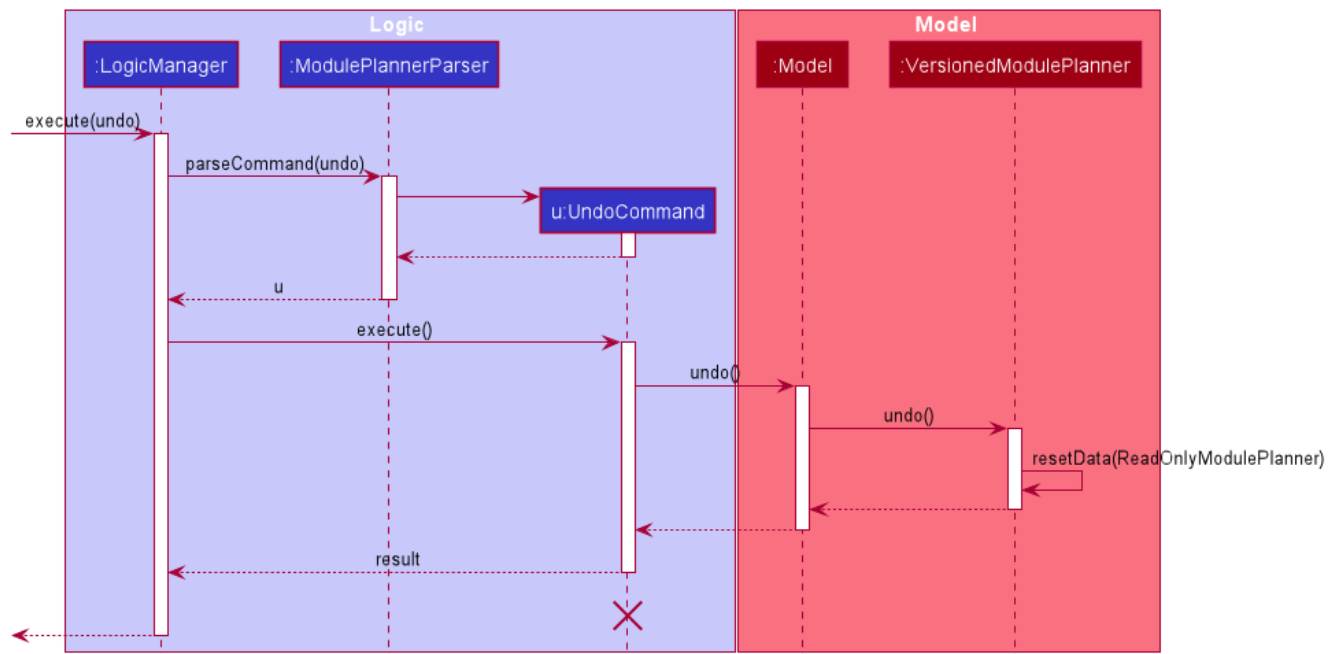
After command "undo"



NOTE

If the `currentStatePointer` is at index 0, pointing to the initial module planner state, then there are no previous module planner states to restore. The `undo` command uses `Model#canUndo()` to check if this is the case. If so, it will return an error to the user rather than attempting to perform the undo.

The following sequence diagram shows how the undo operation works:



NOTE

The lifeline for `UndoCommand` should end at the destroy marker (X) but due to a limitation of PlantUML, the lifeline reaches the end of diagram.

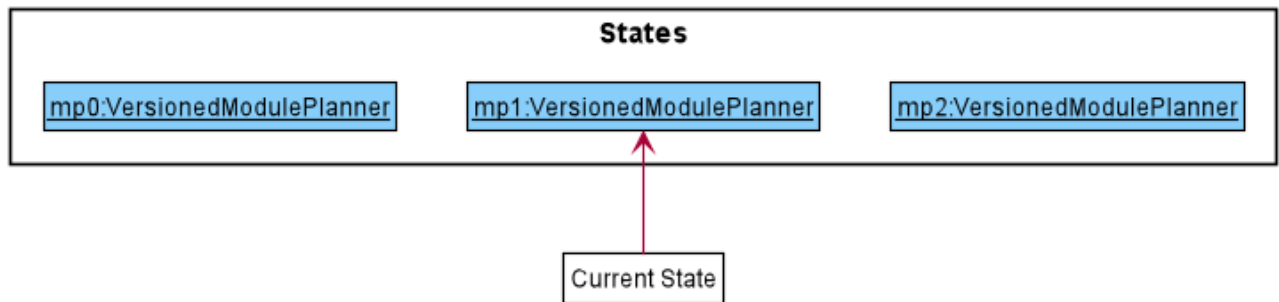
The `redo` command does the opposite—it calls `Model#redo()`, which shifts the `currentStatePointer` once to the right, pointing to the previously undone state, and restores the module planner to that state.

NOTE

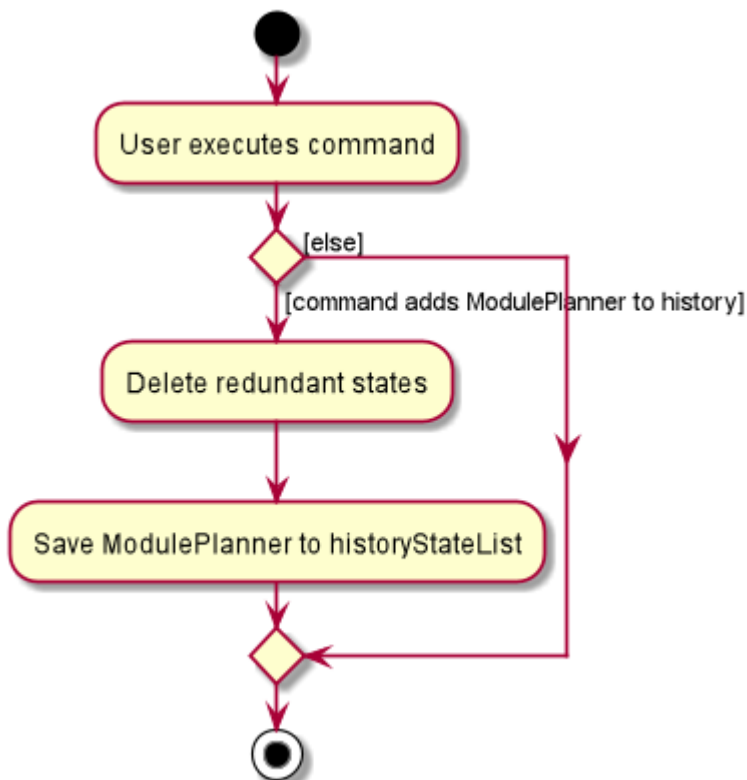
If the `currentStatePointer` is at index `historyStateList.size() - 1`, pointing to the latest module planner state, then there are no undone module planner states to restore. The `redo` command uses `Model#canRedo()` to check if this is the case. If so, it will return an error to the user rather than attempting to perform the redo.

Step 5. The user then decides to execute the command **history**. Commands that do not modify the module planner, such as **history**, will usually not call **Model#addToHistory()**, **Model#undo()** or **Model#redo()**. Thus, the **historyStateList** remains unchanged.

After command "history"



The following activity diagram summarizes what happens when a user executes a new command:



3.1.2. Design Considerations

Aspect: How undo & redo executes

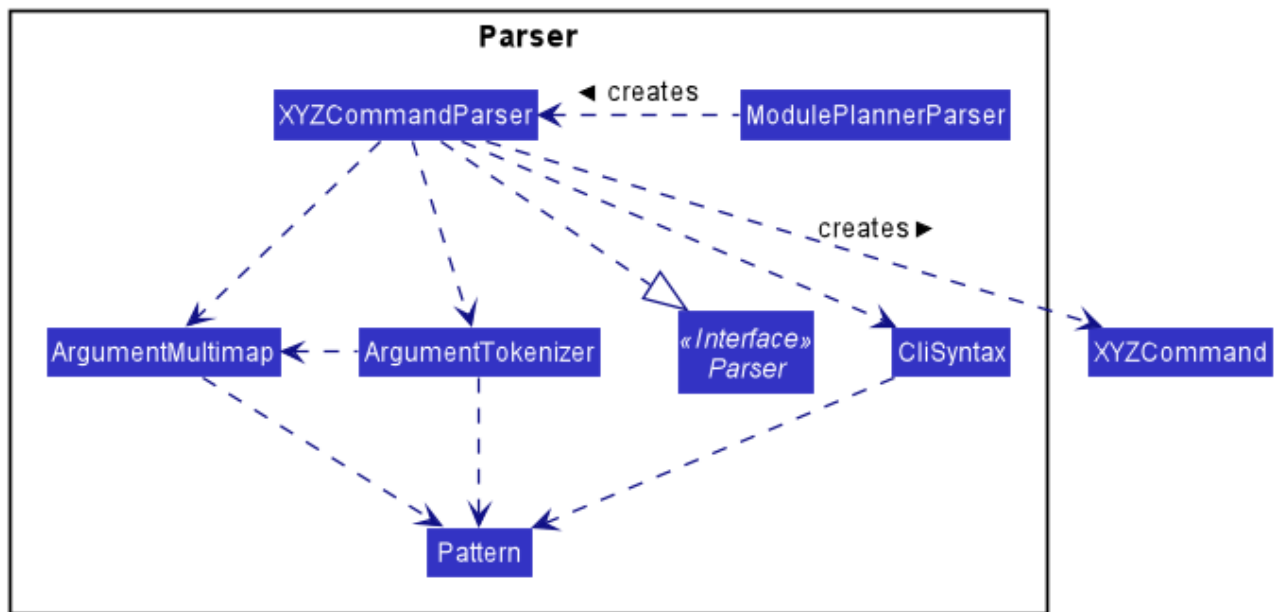
- **Alternative 1 (current choice):** Saves a copy of the entire module planner in the **historyStateList**. It does this by performing a clone operation through the hierarchy of classes of the ModulePlanner, from StudyPlan, Semester, Module down to Tag.
 - Pros: Easier to implement.
 - Cons: May have performance issues in terms of memory usage. Need to take note of the implications of cloning all the objects.

- **Alternative 2:** Implement redo/undo for every single command.
 - Pros: Will use less memory (e.g. for **removemod**, just save the module being deleted).
 - Cons: Tedious because there are a lot of commands and we must ensure that the implementation of each individual command are correct.

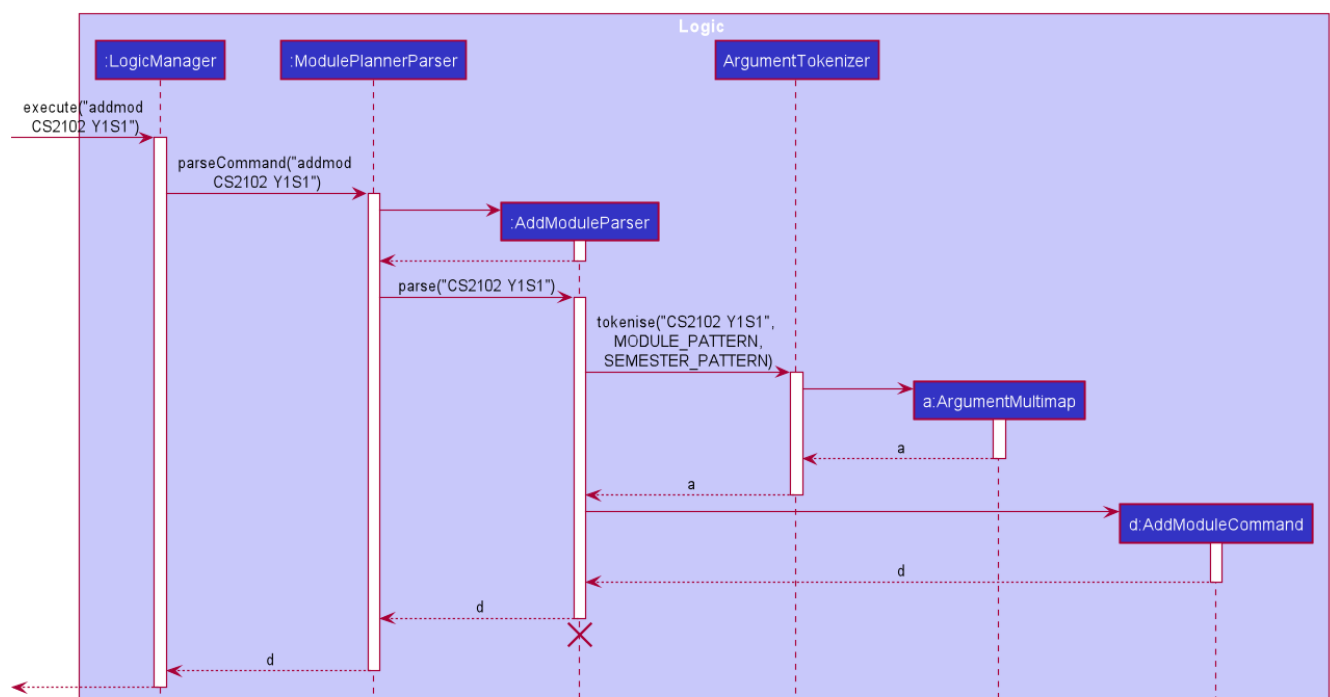
3.2. Parser

3.2.1. Current Implementation

The current parsing mechanism is facilitated by **ArgumentTokenizer** and **ArgumentMultimap**.



Given below is an example usage scenario and how the parsing mechanism behaves at each step.



Step 1. The user enters the `addmod MODULE_CODE SEMESTER` command to add a module with the module code `MODULE_CODE` to the semester with the name `SEMESTER`. In this case, the command entered is `addmod CS2102 Y1S1`.

Step 2. The `Ui` component sends the command to the `LogicManager` to parse the command. The `ModulePlannerParser` detects the `COMMAND_WORD` of the command, `addmod`, and creates an instance of the `AddModuleParser` class.

Step 3. The `AddModuleParser` instance then calls `ArgumentTokeniser` static method, `tokenise`, with arguments `ARG_STRING`, `MODULE_PATTERN` and `SEMESTER_PATTERN`. These patterns are instances of Java `Patterns` class and are pre-defined in the `CliSyntax` class. They are passed into the `tokenise` method so that the `ArgumentTokeniser` knows to parse to find these patterns.

Step 4. The `ArgumentTokeniser` then creates an `ArgumentMultiMap` based on the specified patterns, which is then returned to the `AddModuleParser`.

Step 5. The `ArgumentMultiMap` is then used to obtain the arguments to create an instance of the `AddModuleCommand` class.

3.2.2. Design Considerations

Aspect: How parser is implemented

- **Alternative 1 (current choice):** Use Java `Pattern` class to detect argument types.
 - Pros: User no longer has to type prefixes before each argument type to declare the parameter of the argument.
 - Cons: Difficult to implement because it requires a lot of corner case detection, and also does not consider the order of arguments being entered.
- **Alternative 2:** Use prefixes (similar to that implemented in Address Book 3) so that user declares type of parameter before each argument in the command.
 - Pros: Easy to implement.
 - Cons: User has to type in prefixes, which will reduce ease and efficiency of application use.

3.3. Version Tracking

3.3.1. Current Implementation

The version tracking mechanism (or *commit* mechanism) is facilitated by `VersionTrackingManager`. It is stored as an instance attribute of a `ModulePlanner` object. Additionally, it implements the following operations:

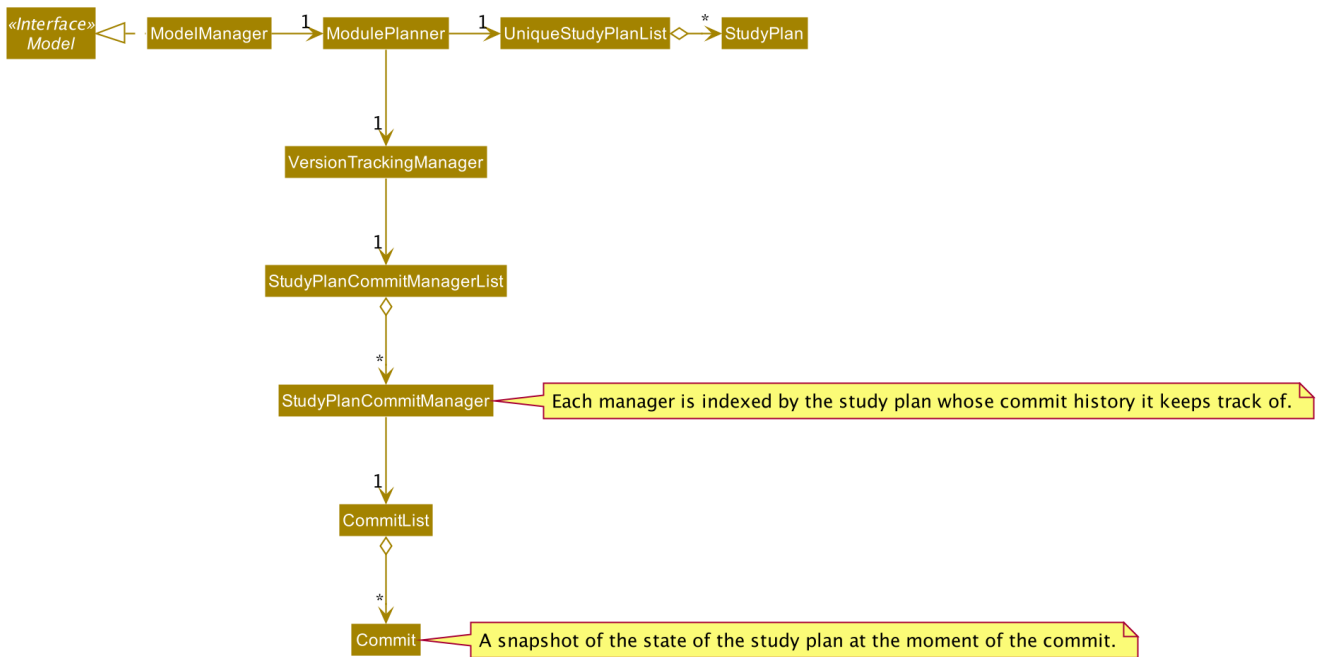
- `VersionTrackingManager#getStudyPlanCommitManagerByStudyPlan(StudyPlan studyPlan)` — Returns the `StudyPlanCommitManager` for the specified study plan.
- `VersionTrackingManager#commitStudyPlan(StudyPlan studyPlan, String commitMessage)` — Saves the current state of the study plan in its history stored in its corresponding `StudyPlanCommitManager`, together with a commit message.

- `VersionTrackingManager#deleteStudyPlanCommitManagerByIndex(int index)` — Deletes a `StudyPlanCommitManager` specified by the index of its corresponding study plan.

These operations are exposed in the `Model` interface as `Model#commitActiveStudyPlan(String commitMessage)`, `Model#deleteStudyPlanCommitManagerByIndex(int index)` etc.

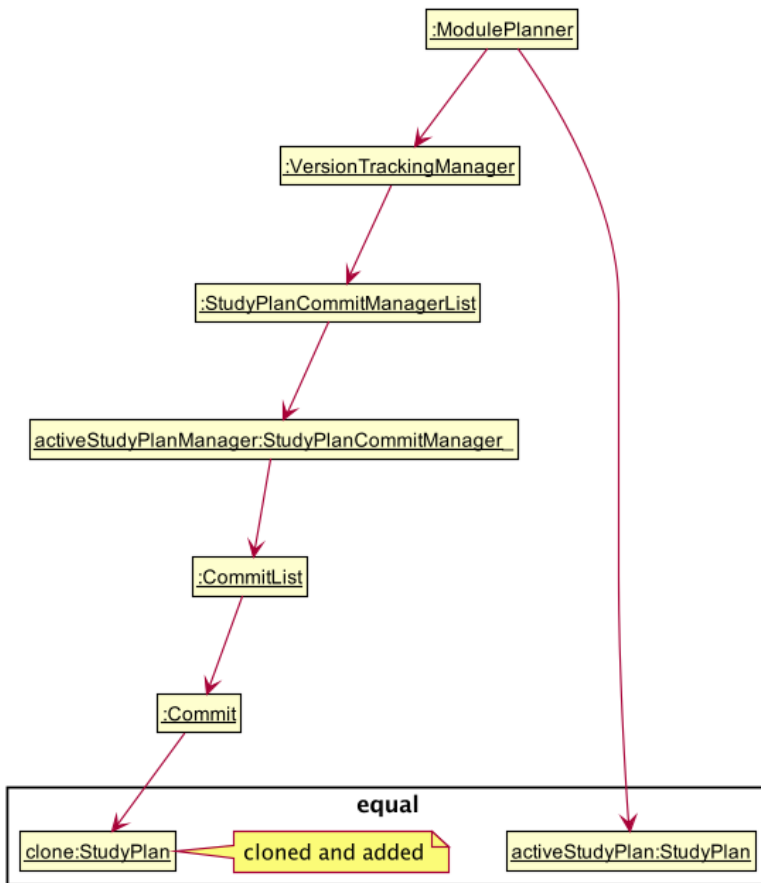
Given below is an example usage scenario and how the commit mechanism behaves at each step.

Step 1. The user launches the application for the first time. The `VersionTrackingManager` will be initialized with the initial module planner state, and its `StudyPlanCommitManagerList` will only contain a manager for the default study plan.

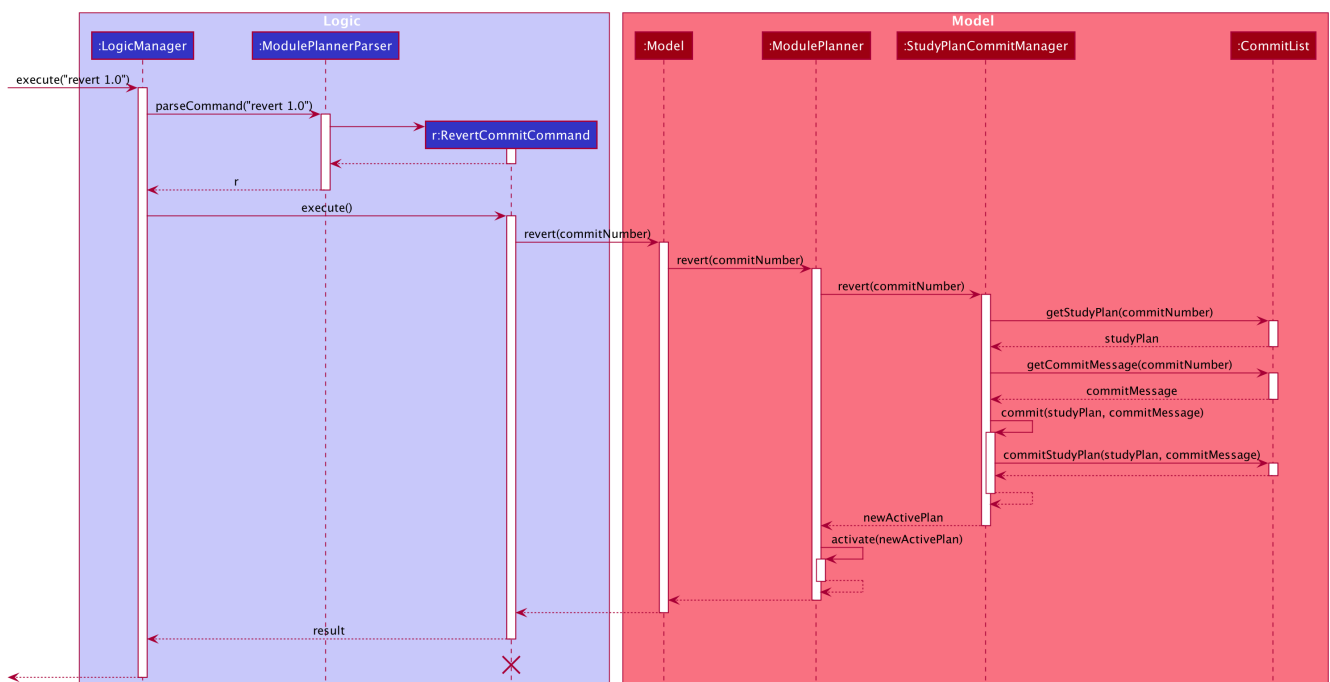


Step 2. After changing the state of the current active study plan (e.g. by calling `addmod cs1101s y1s1`), the user executes `commit first draft` command to save the current state of this study plan with the commit message `first draft`. The `commit` command calls `Model#commitActiveStudyPlan(String commitMessage)`, causing the modified state of the current active study plan after the execution of the `commit first draft` command to be cloned and saved in the `StudyPlanCommitManager` corresponding to this study plan, inside the `VersionTrackingManager` under `ModulePlanner`.

After command "commit [COMMIT_MESSAGE]"



Step 3. The user executes `revert 1.0` to revert to the commit indexed by `0` in the active study plan which has an ID of `1`. The `revert` command also calls `Model#revertCommit(int studyPlanIndex, int commitNumber)`, causing the state of the study plan stored in this commit to be made active, and this reverted state to be saved into the `StudyPlanCommitManager` inside the `VersionTrackingManager` as a revert commit.



(simplified diagram to reduce clutter; `revertToCommit` is abbreviated as `revert` etc.)

NOTE

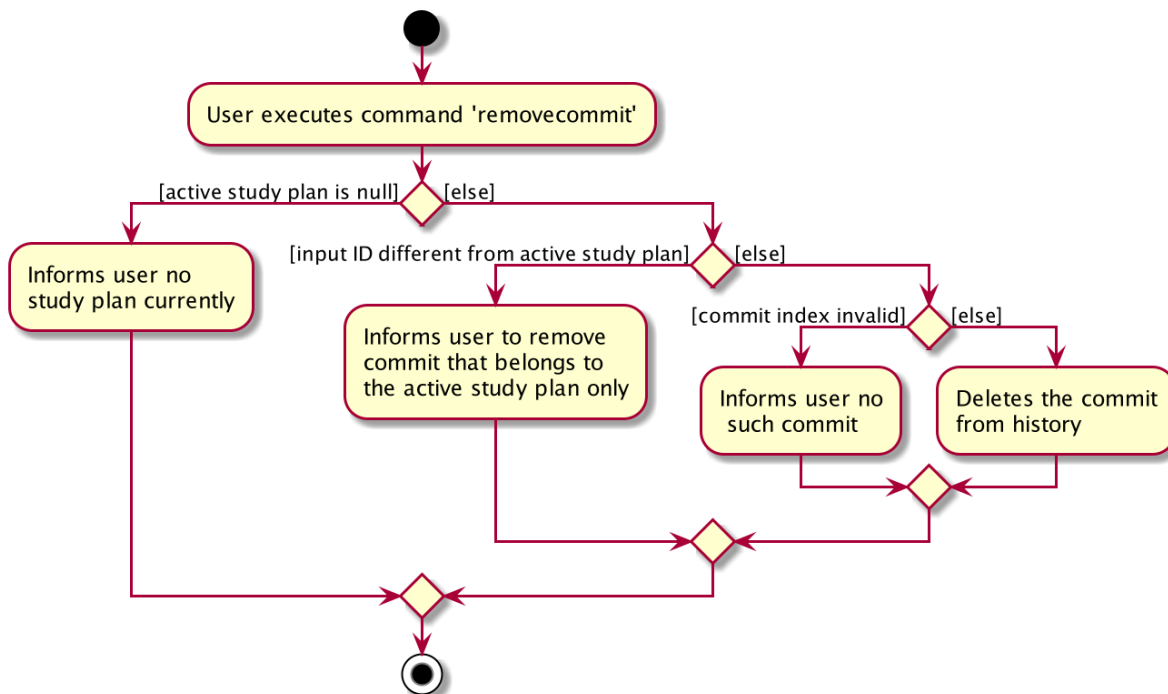
If a study plan does not have any commit history, it will not call `Model#revertCommit(int studyPlanIndex, int commitNumber)`, so that no commit will be made active. Instead it will prompt the user to create commits first.

Step 4. The user now decides that there is a commit that they want to delete from the history completely, and decides to delete that commit by executing the `removecommit` command. The `removecommit` command will call `Model#deleteCommit(int studyPlanIndex, int commitNumber)`, which will delete the commit specified by the `commitNumber` from the history of the study plan with ID `studyPlanIndex`.

NOTE

If the commit number entered does not refer to a valid commit (e.g. there is no commit at all or the index is out of bounds), no deletion will take place. Instead the user will be prompted by an error message.

The following activity diagram shows how the `removecommit` operation works:



3.3.2. Design Considerations

Aspect: How commit executes

- **Alternative 1 (current choice):** Saves the entire state of the study plan at the moment of commit.
 - Pros: Easy to implement.
 - Cons: May have performance issues in terms of memory usage.
- **Alternative 2:** Only saves the difference of the current state from the state of the last commit.
 - Pros: Will use less memory (e.g. for `addmod`, just store the module being added).
 - Cons: We must ensure that the differences in states are stored and loaded correctly when we switch between commits.

Aspect: Data structure to support the commit commands

- **Current choice:** Use a list to store the history of commits for each study plan.
 - Pros: Easy to implement. Each study plan has a clear history of its own.
 - Cons: Hard to handle the possibility of branching (which is currently disallowed).

3.4. Logging

We are using `java.util.logging` package for logging. The `LogsCenter` class is used to manage the logging levels and logging destinations.

- The logging level can be controlled using the `logLevel` setting in the configuration file (See [Section 3.5, “Configuration”](#))
- The `Logger` for a class can be obtained using `LogsCenter.getLogger(Class)` which will log messages according to the specified logging level
- Currently log messages are output through: `Console` and to a `.log` file.

Logging Levels

- **SEVERE** : Critical problem detected which may possibly cause the termination of the application
- **WARNING** : Can continue, but with caution
- **INFO** : Information showing the noteworthy actions by the App
- **FINE** : Details that is not usually noteworthy but may be useful in debugging e.g. print the actual list instead of just its size

3.5. Configuration

Certain properties of the application can be controlled (e.g user prefs file location, logging level) through the configuration file (default: `config.json`).

3.6. Tagging Feature

3.6.1. Implementation

The tagging mechanism is facilitated by `UserTag`, `DefaultTag`, `PriorityTag` and `UniqueTagList`.

`UserTag`, `DefaultTag` and `PriorityTag` all implement the `Tag` interface. Specifically, `UserTag` and `DefaultTag` are attached to modules and `PriorityTag` is attached to study plans.

Module Tags

`UserTag` represents user-created tags while the `DefaultTag` represents default tags of one of the types in `DefaultTagType`. The key difference between `UserTag` and `DefaultTag` is that the first is user-modifiable while the second is not and is essentially immutable. The operation `Tag#isDefault()` is implemented to identify a `Tag` as a `DefaultTag`.

Study Plan Tags

`PriorityTag` represents a priority tag of one of the types in `PriorityTagType`. The user can attach a `PriorityTag` to a study plan to indicate its priority level. The operation `Tag#isPriority()` is implemented to identify a `Tag` as a `PriorityTag`.

UniqueTagList

Each `Tag` is stored in a `UniqueTagList`, which implements `Iterable<Tag>` and is stored internally in `Module` and `StudyPlan`. It represents a list of tags that can be of type `UserTag`, `DefaultTag` or `PriorityTag` and enforces the uniqueness between them. Each `StudyPlan` has two unique tag lists, one for its `PriorityTag` and another for all of its modules' tags. The purpose of storing the `PriorityTag` in a `UniqueTagList` instead of as independent attribute is to allow for further extensions to study plan tagging, i.e. allowing study plans to have other kinds of tags. `UniqueTagList` implements the following operations:

- `UniqueTagList#addTag(Tag toAdd)` — Adds the given `Tag` to the list.
- `UniqueTagList#removeTag(Tag toRemove)` — Removes the given `Tag` from the list.
- `UniqueTagList#containsTagWithName(String tagName)` — Checks if the list contains a `Tag` with the given `tagName`.
- `UniqueTagList#getTag(String tagName)` — Returns the `Tag` with the given `tagName`.

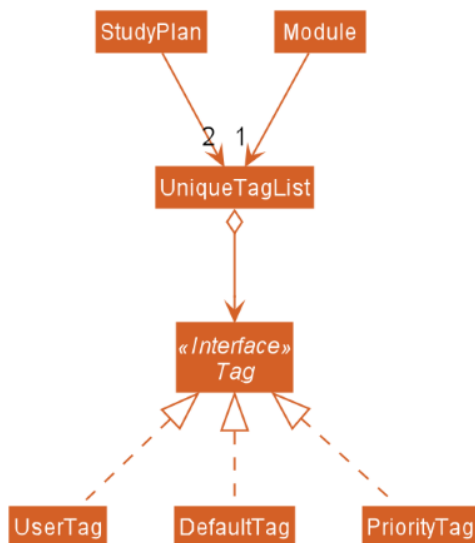


Figure 8. Class diagram for the tag model

There are many operations that can be done in relation to tagging modules. Some examples are *adding*, *deleting*, and *renaming* tags. Given below is an example usage scenario of the `UniqueTagList#addTag(Tag toAdd)` operation and how the module tagging mechanism behaves at each step.

Step 1. The user executes the `addtag MODULE_CODE TAG_NAME` command to add a tag with the name `TAG_NAME` to the module with the module code `MODULE_CODE`. A `toAdd` variable of type `Tag` and a boolean value `newTagCreated` is maintained during the execution of the command to represent the tag that is to be added and whether or not a new tag has been created respectively. The `addtag` command calls `Model#activeSpContainsTag(String tagName)` to check if the active study plan contains

a tag with the given `tagName`. This method accesses the active study plan in the module planner and checks if such a tag exists in its `UniqueTagList`. There are two possible scenarios that are described in steps 2 and 3.

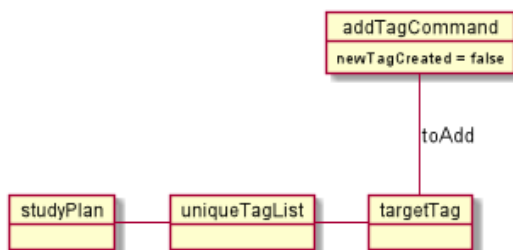
Step 2. If such a tag does not exist, a new `UserTag` is created and is assigned to `toAdd`.

AddTagCommand (New tag is created)



Step 3. If such a tag exists, `Model#getTagFromActiveSp(String tagName)` is called. The `Tag` in the `UniqueTagList` of the active study plan is returned and assigned to `toAdd`. `Tag#isDefault()` is called to check if the returned `Tag` is a `DefaultTag`. If so, a `CommandException` is thrown as default tags cannot be added by users.

AddTagCommand (New tag is not created)



NOTE

We only have to handle the case of adding default tags in this step and not in the previous step as default tags are already initialised into the study plan and hence `Model#activeSpContainsTag(String tagName)` will always return true if the given name is a default tag name.

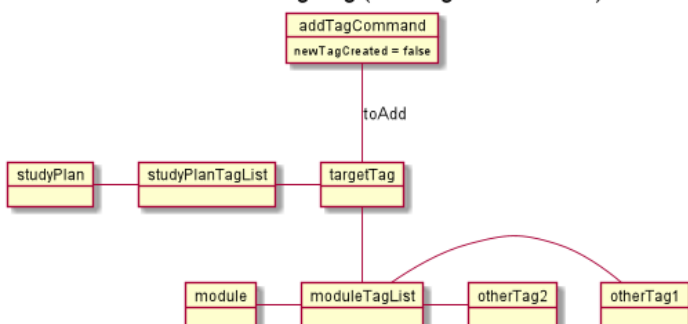
Step 4. `Model#addTagToActiveSp(UserTag toAdd, String moduleCode)` is called to add `toAdd` to the module with the given module code. This method accesses the module with the given `moduleCode`, which will call `Module#addTag(Tag tag)` to add `toAdd` to its `UniqueTagList`. In the case that `toAdd` already exists in the `UniqueTagList`, it will not be added, and the method will return `false`. (Step 5)

NOTE

The above scenario should not occur if a new tag had been created as described in Step 2.

Otherwise, the `toAdd` will be added and the method will return `true`. (Step 6)

Module after adding Tag (New tag is not created)



Step 5. If the tag had not been added, it would indicate that an essentially identical tag had already

been attached to the target module. Hence, a `CommandException` will be thrown.

NOTE

`Tag` has a method `Tag#isSameTag` to identify essentially identical tags by comparing the tag names for `UserTag` (this is case-insensitive) and the `DefaultTagType` for `DefaultTag`.

Step 6: If the tag had been added, a `CommandResult` with a success message is returned.

The following sequence diagram and activity diagram show how the `addtag` command works:

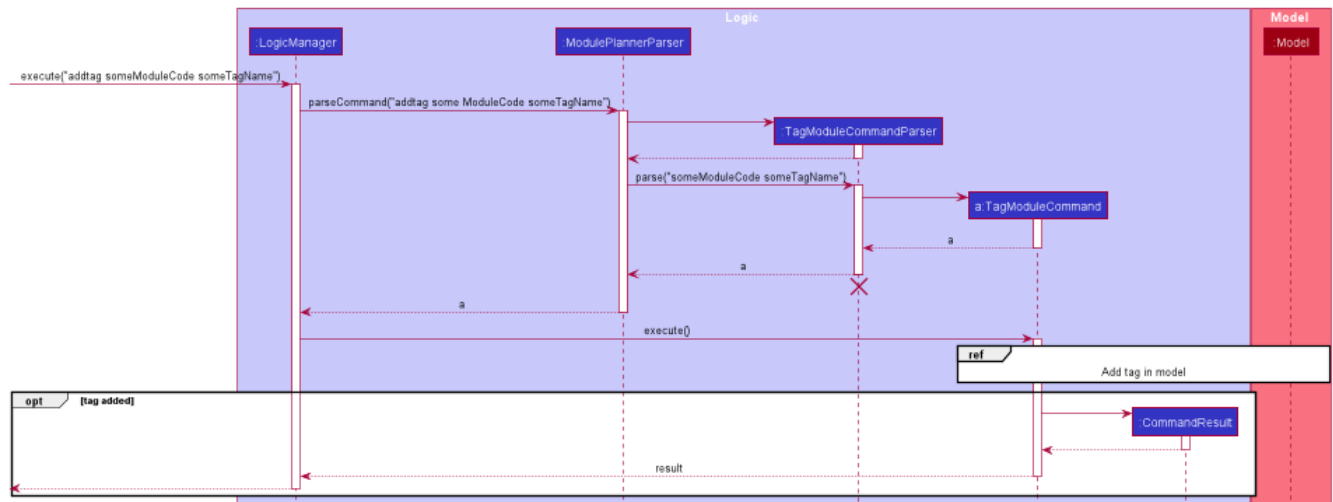


Figure 9. `addtag` command execution

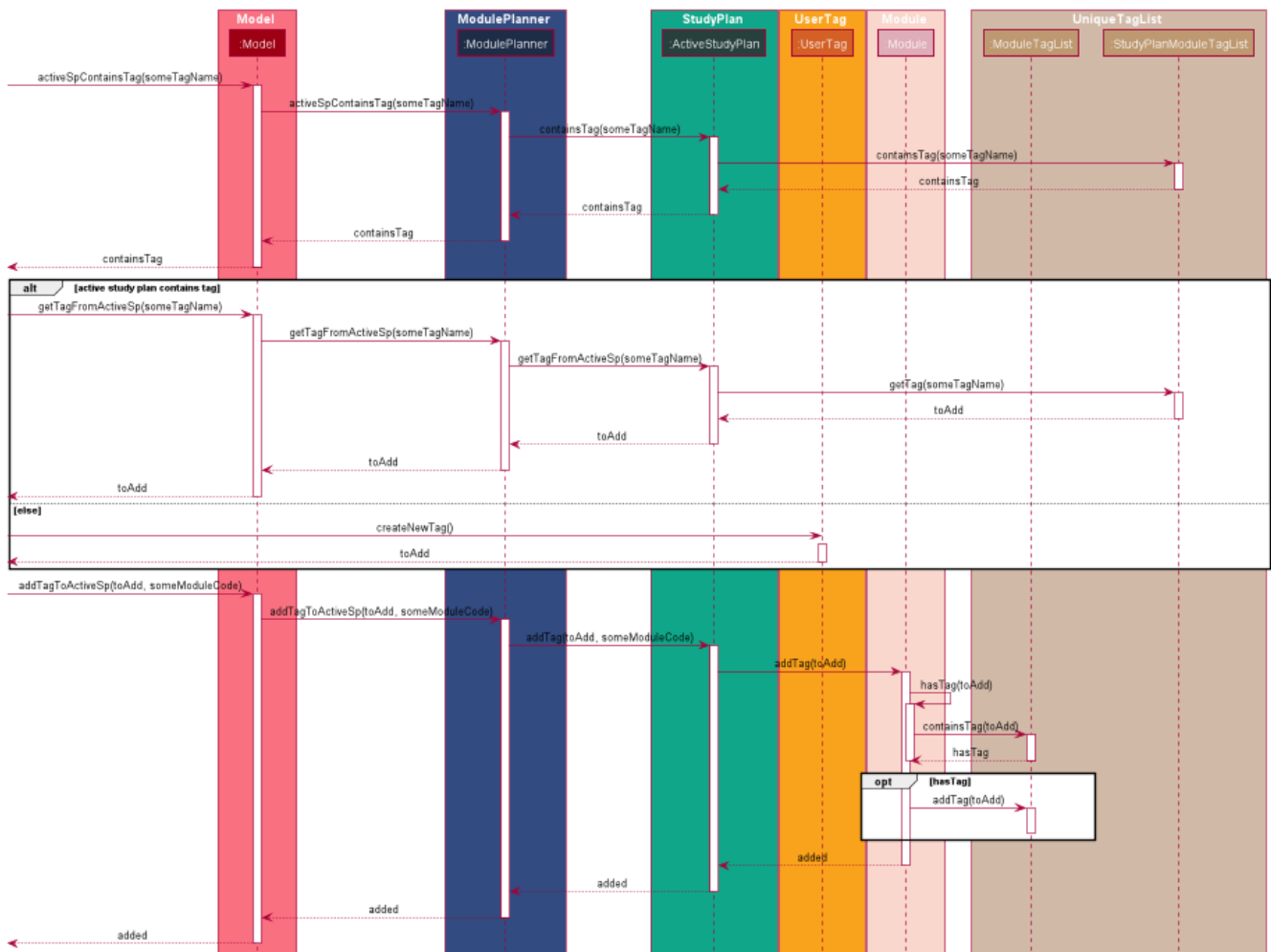


Figure 10. Adding the module tag in the model

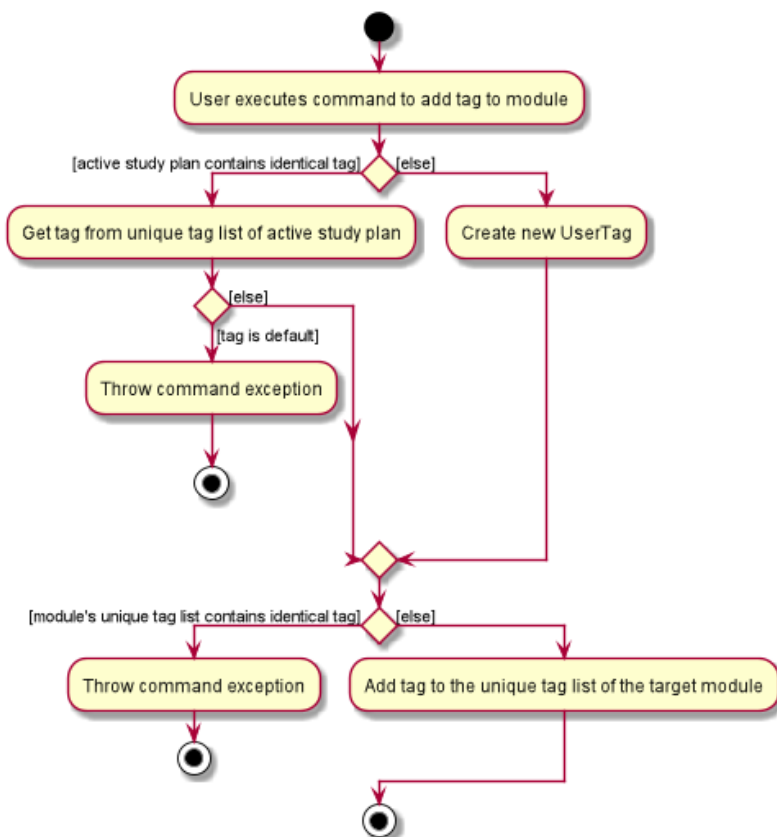


Figure 11. Activity diagram for module tagging

NOTE

The command exceptions in the above activity diagram should actually point to a single *stop* at the end. There are multiple *stops* in the above diagram as PlantUML does not support having a single *stop* and [] for branch labels in one syntax.

3.6.2. Design Considerations

Aspect: How tags are assigned to modules

- **Alternative 1 (current choice):** A tag with a given name is only created once. Adding a tag to a module simply creates a reference from the module to the existing tag.
 - Pros: Reduces memory usage, promotes consistency and makes duplication checking easier (simply check the `UniqueTagList` of the `StudyPlan` instead of checking the list in every `Module`).
 - Cons: More difficult to implement and requires searching and reassignment of pointers every time the command is executed.
- **Alternative 2:** A new tag is created every time a tag is added even if there is already an existing tag with the same name.
 - Pros: Easier to implement as no searching of previous tags need to be done.
 - Cons: Increases memory usage, ensuring consistency and duplication checking might be more difficult (have to check the `UniqueTagList` of every `Module` instead of just the one in the `StudyPlan`).

3.7. Module Information and Verification

3.7.1. Implementation

The reading of modules information is facilitated by `ModulesInfo`, which contains a list of `ModuleInfo` objects.

All information regarding our modules are initially stored in json format, within the file `src/main/resources/modules_cs.json`. Information in a `ModuleInfo` object includes:

- `code`: Module code
- `name`: Module name
- `mc`: MC count
- `su`: Whether the module can be S/U-ed
- `isCore`: Whether the module is a core module
- `focusPrimitives`: List of focus area primaries
- `focusElectives`: List of focus area electives
- `description`: Module description
- `prereqTree`: Module's prerequisite tree

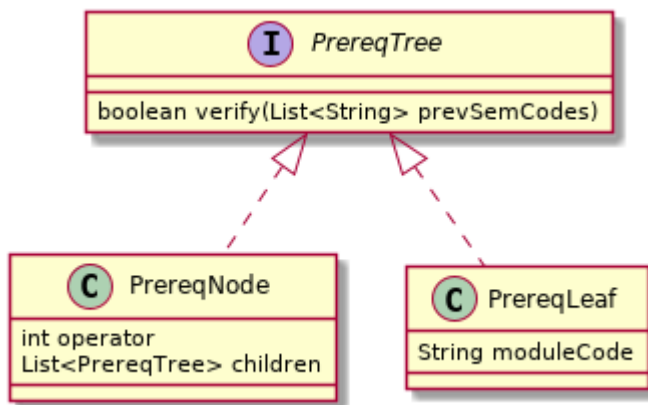
Upon starting the main app, the data is read once into a `ModulesInfo` object, which contains a list of `ModuleInfo` objects—it is then passed into our model, whereby our `ModelManager` holds it as a

reference.

Upon creating a study plan, the module planner will create the relevant **Module** objects, whose information matches their corresponding **ModulesInfo** objects. Each **Module** object should correspond to exactly one **ModuleInfo** object (with the same module code).

3.7.2. Prerequisite checking

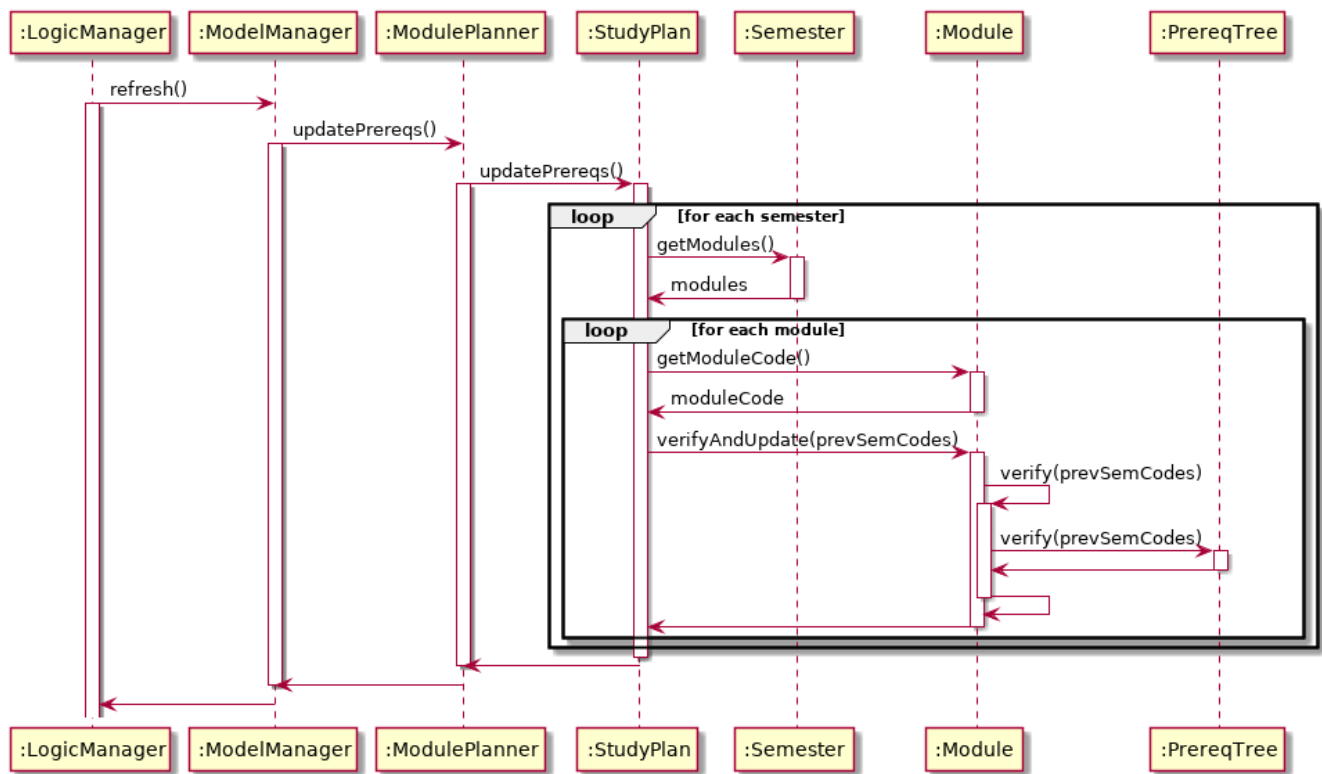
To facilitate prerequisite checking, we have an interface **PrereqTree**, implemented by two classes **PrereqLeaf** and **PrereqNode**.



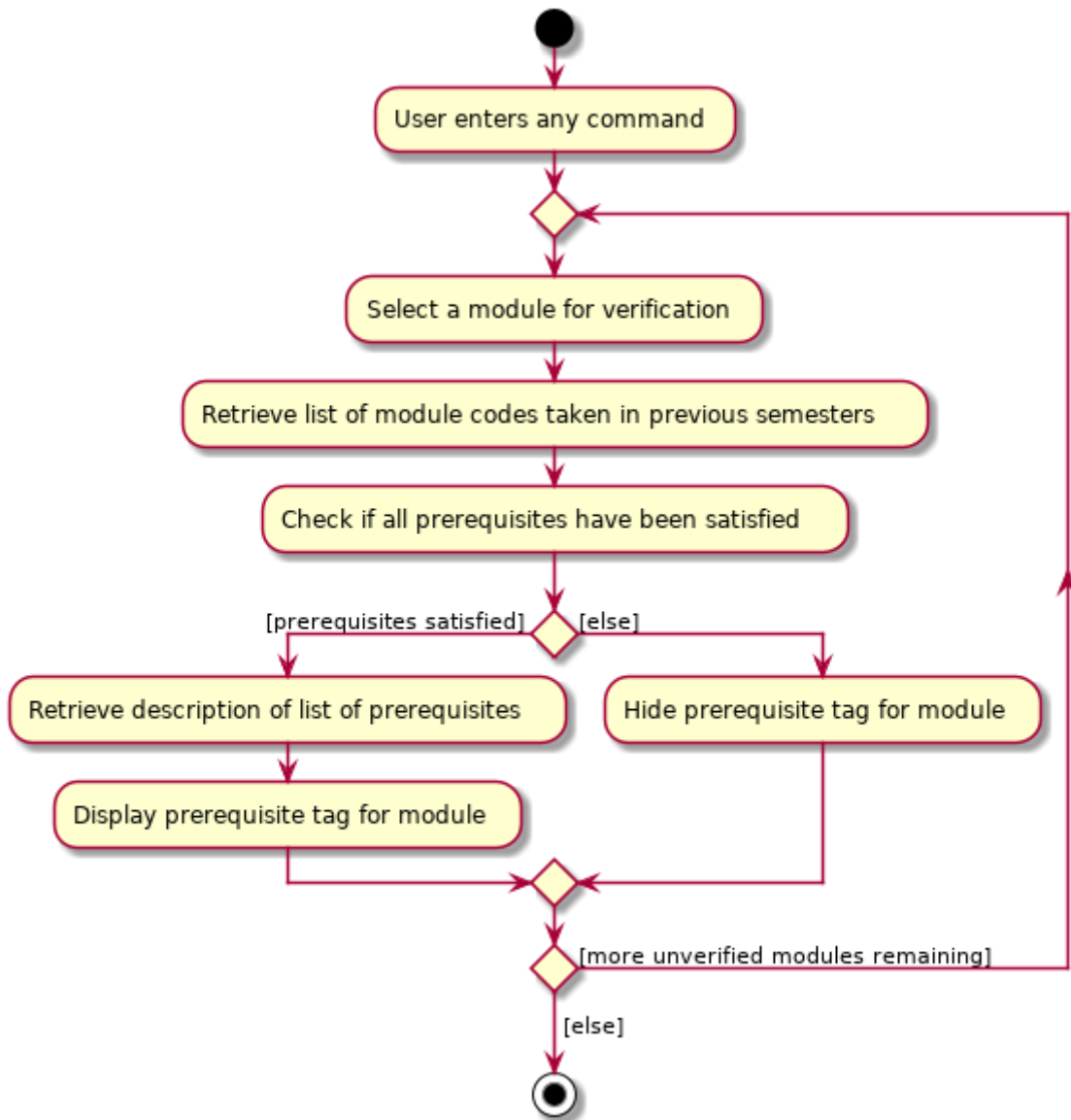
Each **PrereqLeaf** represents a module prerequisite. Each **PrereqNode** has an AND or OR operator—for instance, (CS2030 AND CS2040) would be represented by a **PrereqNode** with the operator AND, with two **PrereqLeaf** leaves: one for CS2030, and one for CS2040.

Importantly, **PrereqTree** contains the method `verify(List<String> prevSemCodes)`. Given a list of strings of module codes taken in previous semesters, the prerequisite tree will return a boolean value, signalling if the module already has its prerequisites satisfied.

Upon executing any command, the method `refresh()` will be called in the module manager, which verifies the prerequisites of every **Module** and updates them in the GUI. Modules that do not have their prerequisites fulfilled will be shown with a red tag beside it.



The following activity diagram shows how the verification works for each module:



3.7.3. Design Considerations

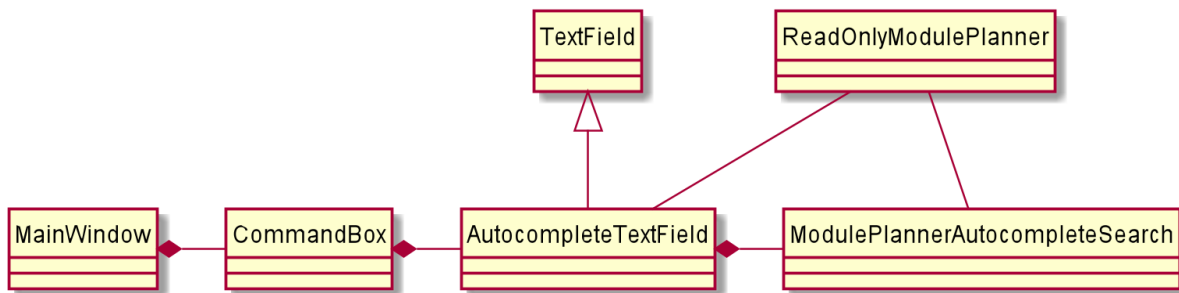
Aspect: Relationship between a module and its module information

- **Alternative 1 (current choice):** All **ModuleInfo** objects are only created once upon initialising the application, one for each CS module. When creating a **Module** object, it then finds the corresponding **ModuleInfo** object (with the same module code), then derives its attributes (e.g. name, MC count, tags) from it.
 - Pros: The json file is only read once to create all **ModuleInfo** objects at once, which is more efficient.
 - Cons: It could lead to greater code complexity, as the model manager needs to keep track of not only **Module** objects, but also **ModuleInfo** objects.
- **Alternative 2:** Whenever a new **Module** object is created, it re-reads the json file to read in the necessary information.
 - Pros: The module manager does not need to persistently hold on to the same list of **ModuleInfo** objects.
 - Cons: It performs the same reading action multiple times, which could lead to slowdowns.

3.8. Autocomplete

3.8.1. Implementation

Class Diagram for Autocomplete



The autocomplete of keywords is facilitated by `AutocompleteTextField`, which inherits from `Textfield`, and `ModulePlannerAutocompleteSearch`. `AutocompleteTextField` handles user input and changing the text in the text field. `ModulePlannerAutocompleteSearch` handles the autocorrect searching for keywords.

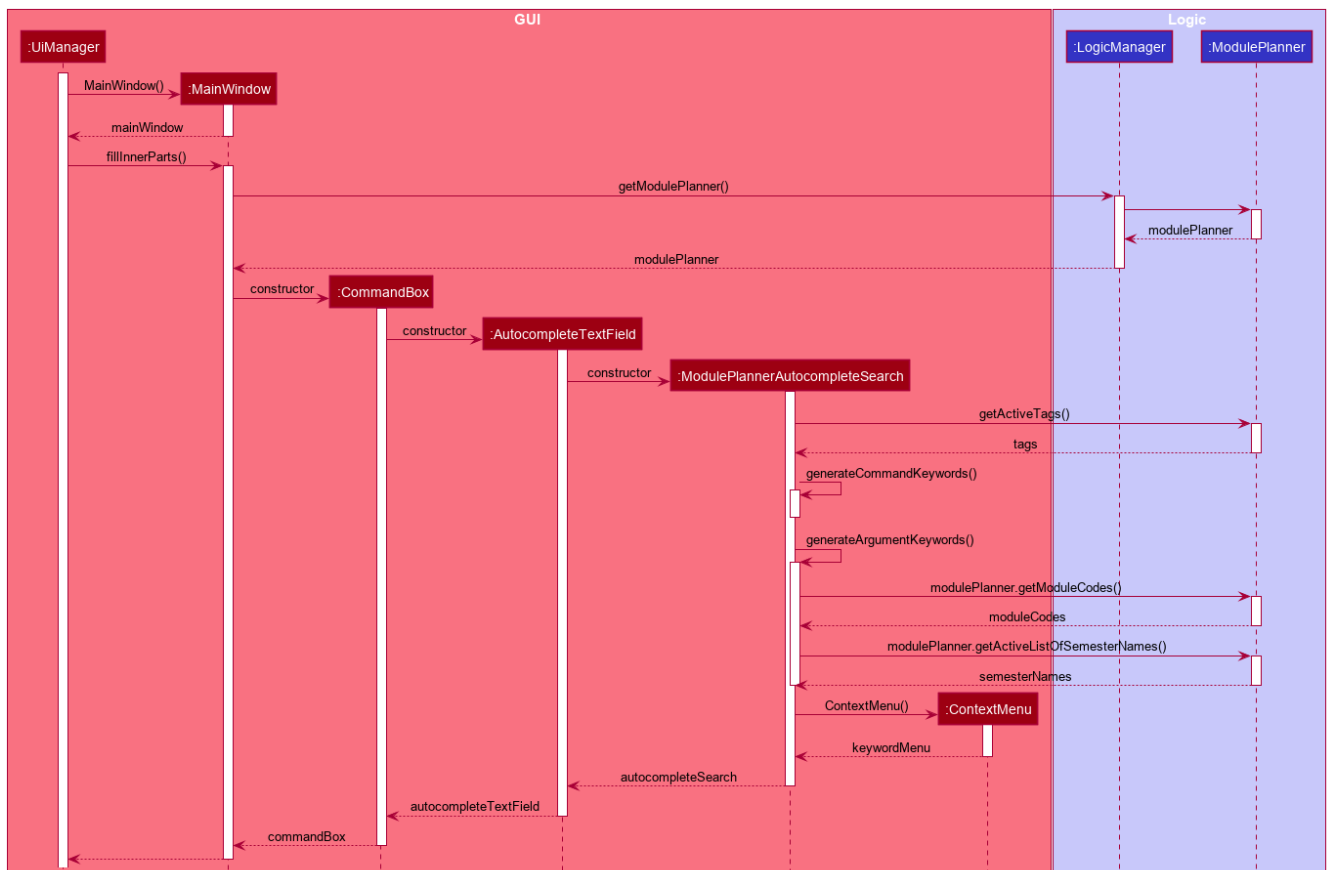
When the `MainWindow` is created, a `CommandBox` is created and added to the GUI. The `CommandBox` creates an `AutocompleteTextField` and it is added to the GUI. The `AutocompleteTextField` holds a `ModulePlannerAutocompleteSearch`.

`CommandBox` attaches a `keyEvent` listener to `AutocompleteTextField` that listens for the `TAB` key press, which starts the autocomplete process.

`ModulePlannerAutocompleteSearch` holds two sets of keywords, a set for commands and a set for arguments. These keywords are represented as `SortedSet<String>`. Within each input, the first word will be autocompleted with the set for commands, while subsequent words (separated by spaces) will be autocompleted with the set for arguments. An exception is the `help` command, in which the subsequent words will be autocompleted with the set for commands.

`ModulePlannerAutocompleteSearch` is constructed with a `ReadOnlyModulePlanner`. It is used to create the keyword sets. Hence, `AutocompleteTextField` is also constructed with a `ReadOnlyModulePlanner` to pass this down.

The following sequence diagram shows the creation of Autocomplete:



`AutocompleteTextField` holds the following public operations:

- `AutocompleteTextField#handleAutocomplete` — Handles the entire autocomplete process based on the current text.
- `AutocompleteTextField#handleChangeOfActiveStudyPlan` — Resets the argument keywords when there is a change in the active study plan.

`ModulePlannerAutocompleteSearch` is never accessed by any external classes.

Given below is an example usage scenario of the `AutocompleteTextField#handleAutocomplete()` operation and how the autocomplete mechanism behaves at each step for commands.

Step 1. The user enters the beginning of a command into the GUI text field, for example "addt" for `addtag`. The user then presses the activation key `TAB` which begins the autocomplete process. The `KeyEvent` listener calls the `AutocompleteTextField#handleAutocomplete()` operation.

Step 2: `AutocompleteTextField` passes the input to `ModulePlannerAutocompleteSearch`, by calling `ModulePlannerAutocompleteSearch#getSearchResults(String input)`. In `ModulePlannerAutocompleteSearch`, the text in the text field is checked. As it is the first word, the keywords set for commands is used. `ModulePlannerAutocompleteSearch#performSearch(String input, SortedSet<String> keywords)` is called to proceed with the search.

Step 3: This method finds search results, which is a subset from the keywords set for commands that begin with the input. This result is returned back through `ModulePlannerAutocompleteSearch#getSearchResults(String input)`. `AutocompleteTextField#handleAutocomplete()` uses the search results to proceed. There are two possible scenarios that are described in Steps 4 and 5.

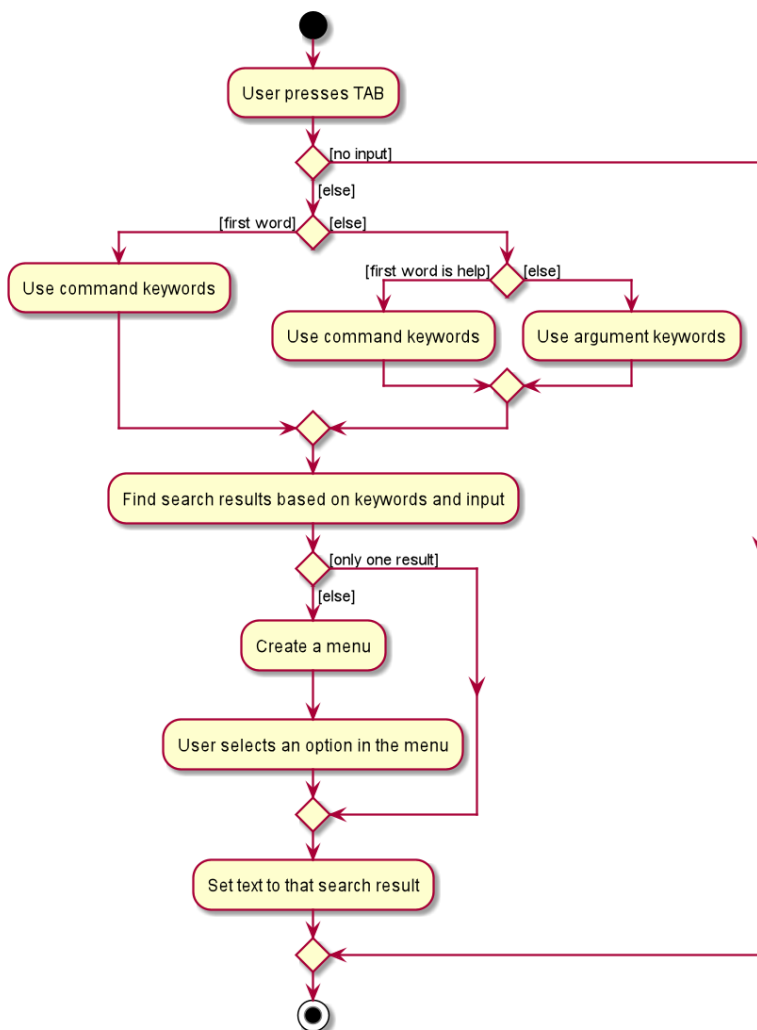
Step 4: If there is only one search result, `AutocompleteTextField#setAutocompleteText(String searchResult)` is called. Proceed to Step 6.

Step 5: If there is more than one search result, a menu will be created for the user to make a selection. This method will call the `populateMenu(List<String> searchResult)` method, and then show the menu if it is not showing. Then, focus will be requested from the first menu item in the menu. The `populateMenu(List<String> searchResult)` populates a `ContextMenu` with `CustomMenuItem`, which correspond to each search result. On action of the menu item, either through clicking or pressing the key `ENTER` while it is focused, `AutocompleteTextField#setAutocompleteText(String searchResult)` is called. Proceed to Step 6.

Step 6: `AutocompleteTextField#setAutocompleteText(String searchResult)` causes the input text to be changed to the search result and the caret positioned at the end of the line.

The autocomplete mechanism behaves similarly for arguments, except the argument set of keywords will be used. Furthermore, `AutocompleteTextField#setAutocompleteText(String searchResult)` will cause the input text to be changed to the text before the space concatenated with a space and the search result and the caret is positioned at the end of the line. This change replicates autocompleting only the last word without erasing previous terms.

The following activity diagram shows how the autocomplete works:



3.8.2. Design Considerations

Aspect: How autocompletion is broken down

- **Alternative 1 (current choice):** One class for handling the text field, one class for handling the querying.
 - Pros: Easier for testing. More cohesion.
 - Cons: More classes written.
- **Alternative 2 :** One class to handle everything.
 - Pros: Easier to code.
 - Cons: Harder to test.

Aspect: How arguments are completed

- **Alternative 1 (current choice):** All arguments including semester names, tags and module codes are checked for together.
 - Pros: Easy to implement.
 - Cons: User may want to only be autocompleting for tags, but module codes appear as well.
- **Alternative 2:** Arguments are identified as tags or module codes and autocompleted based on the command.
 - Pros: User can autocomplete without undesired suggestions.
 - Cons: The command will have to be parsed upon autocomplete call, which will take more time and alter the structure of parsing commands.

Aspect: How help is implemented

- **Alternative 1 (current choice):** Help is treated as a special case.
 - Pros: Easy to implement. Help is the only command that takes in commands as arguments.
 - Cons: A hard-coded exception does not make the code extensible.
- **Alternative 2:** Every command is parsed and their keywords identified.
 - Pros: More extensible as help is future commands can take in commands as keywords.
 - Cons: The command will have to be parsed upon autocomplete call, which will take more time and alter the structure of parsing commands.

4. Documentation

Refer to the guide [here](#).

5. Testing

Refer to the guide [here](#).

6. Dev Ops

Refer to the guide [here](#).

Appendix A: Product Scope

Target user profile:

- Undergraduate CS student studying in NUS
- Needs to manage his/her study plans and module planning
- Needs to see whether his/her study plans are feasible
- Prefer desktop apps over other types
- Can type fast
- Prefers typing over mouse input
- Is reasonably comfortable using CLI apps

Value proposition:

- Functionality is not offered by any other existing application.
- Tailored to needs of NUS CS undergraduate students.
- Users will be able to check all the problems (e.g. graduation requirements, prerequisite for modules) with their current study plan with ModBuddy through a desktop application.
- Have multiple study plans, and move semesters around quickly with a CLI.
- Version control for saving history of study plans, ensuring that mistakes or past study plans are recoverable.
- Suits users who are able to type fast and can manage their study plan faster.

Appendix B: User Stories

Priorities: High (must have) - * * *, Medium (nice to have) - * *, Low (unlikely to have) - *

Priority	As a ...	I want to ...	So that I can...
* * *	student	add modules to the planner	
* * *	student	remove modules from the planner	

Priority	As a ...	I want to ...	So that I can...
* * *	student	search a module based on module code	
* * *	student	declare my focus area	
* * *	student	ensure that my modules can fulfill my focus area requirements	
* * *	student who wants to graduate	know whether I will fulfill my graduation requirements with my current study plan	I can graduate on time
* * *	user	check a module's prerequisites	I can confirm I've satisfied them in previous semesters before taking the module this semester
* * *	user	set my current semester	
* * *	foolish user	be warned if any part of my study plan is not feasible	
* * *	indecisive user	move modules across semesters	I can change the order at which I plan to take my modules
* * *	forgetful user	view which modules I have already taken	I know what modules I do not have to take anymore

Priority	As a ...	I want to ...	So that I can...
* * *	Year 1 user	view the core modules	I know which modules I should take first
* * *	new user	view help instructions	I know how to use the application easily
* * *	clumsy user	be greeted with helpful error messages when I enter commands or their arguments wrongly	
* * *	meticulous student	create multiple versions of study plan	I can toggle between them and choose the most suitable one when circumstances change
* *	Year 1 user	view which modules can be S/U-ed	I can prioritise those modules to be taken in Year 1
* *	user with friends	download a copy of my study plan	I can share it with others.
* *	user	check the total number of MCs in my module plan this semester	I know if I need to take more modules or if I'm overloading.
* *	foolish user	undo my previous command	I can restore the previous state whenever I make mistakes.

Priority	As a ...	I want to ...	So that I can...
* *	Year 1 user	start out with a default module plan	I have an idea of what modules are recommended to be taken in which semesters
* *	ambitious student	to block out a semester	I can plan for SEP/NOC/industrial attachment.
* *	lazy student	see a brief description/name of a module	I don't have to memorise all the module codes
* *	student	search a module based on keywords	
* *	diligent student	tag my modules so as to classify them better	
* *	student	fill my study plan with UEs too	
* *	student	rename UEs as their actual names	
* *	visual user	be able to visualise my modules in a GUI	
* *	experienced user	chain my commands together so that I can be more efficient	
* *	student who admires beauty	see different colours	

Priority	As a ...	I want to ...	So that I can...
* *	forgetful student	attach more information to each semester	I will remember why I plan my modules this way
* *	fickle user	combine different semesters from different study plans into one new study plan (move semesters around)	I don't have to repeat.
* *	student who wants to be a TA	indicate I will be TA-ing a module in a given semester	
* *	CS student with extra programmes	I want to verify that my study plan allows me to graduate with all the different requirements I have	
*	overachiever	I want to see how joining one of these Turing/von Neumann programmes affects my study plan	
*	student who wants to be a TA	indicate I will be TA-ing a module in a given semester	

Priority	As a ...	I want to ...	So that I can...
*	CS student with extra programmes	I want to verify that my study plan allows me to graduate with all the different requirements I have	
*	CS student with friends	I want to plan modules with my friends	we can take the same modules every semester
*	student who cares about grades	I want to be able to analyse my CAP per module, semester, year and overall	I can be more aware of my grades
*	user who admires beauty	I want to set each module with a color 1-8	I can customise the look of my study plan
*	user who admires beauty	I want to change the color theme	I can customise the look of my study plan
*	experienced user who admires beauty	I want to change specific colors with hex code	I can customise the look of my study plan

Appendix C: Use Cases

(For all use cases below, the **System** is the **ModBuddy** and the **Actor** is the **Student**, unless specified otherwise)

C.1. Use case: UC01 - Create study plan

MSS

1. User chooses to create a study plan.
2. User enters the title of the study plan.
3. ModBuddy displays the new study plan.

Use case ends.

Extensions

2a. User chooses not to enter a title.

- 2a1. ModBuddy creates a new study plan with a default title.
- 2a2. Use case resumes from step 3.

Use case ends.

C.2. Use case: UC02 - Add module

MSS

1. Student requests to add a module to a particular semester.
2. ModBuddy displays changes to study plan.

Use case ends.

Extensions

1a. ModBuddy detects that the module entered does not exist.

- 1a1. ModBuddy prompts Student to enter a correct module code
- 1a2. User enters new module.

Steps 1a1-1a2 are repeated until the data entered are correct.

Use case ends. === Use case: UC03 - Commit a study plan

MSS

1. Student requests to save the current version of the study plan.
2. ModBuddy confirms that the version has been saved.

Use case ends.

Extensions

1a. ModBuddy detects that there have been no changes to the study plan from the previous commit.

- 1a1. ModBuddy informs Student that the current version has already been saved.

Use case ends.

C.3. Use case: UC04 - Tag a module

MSS

1. Student requests to tag a module
2. ModBuddy requests student to enter a tag name.
3. ModBuddy displays changes to study plan.

Use case ends.

Extensions

1a. ModBuddy detects that the module entered does not exist.

- 1a1. ModBuddy prompts Student to enter a correct module code
- 1a2. User enters new module.

Steps 1a1-1a2 are repeated until the data entered are correct.

Use case resumes from step 3.

2a. ModBuddy detects that the module already has the tag.

- 2a1. ModBuddy does not add a new tag.

Use case ends.

C.4. Use case: UC05 - Correct modules without a prerequisite

MSS

1. ModBuddy highlights a module in red because its prerequisites have not been fulfilled.
2. Student checks the prerequisites of the module.
3. ModBuddy displays all a module's prerequisites that have yet to be fulfilled in previous semesters.
4. Student adds the unfulfilled module prerequisite to a selected previous semester.
5. ModBuddy un-highlights the module now that its prerequisites have been fulfilled.

Use case ends.

Extensions

1a. Student decides not to take the module.

- 1a1. Student removes the module from the semester.

Use case ends.

3a. Student checks if the module to be added is valid in a selected previous semester.

Use case resumes from step 4.

C.5. Use case: UC06 - Chaining commands

MSS

1. User chooses to chain multiple commands
2. User inputs the multiple commands.
3. ModBuddy displays the changes as specified.

Use case ends.

Extensions

- 2a. User chooses to chain different commands with '&&'.
- 2b. User chooses to chain same commands with multiple arguments.

Appendix D: Non Functional Requirements

1. Should work on any mainstream OS as long as it has Java 11 or above installed.
2. Should be able to hold up to 10 study plans, each containing at least 40 modules, without a noticeable sluggishness in performance for typical usage.
3. Should allow a user with above average typing speed for regular English text (i.e. not code, not system admin commands) to accomplish most of the tasks faster using commands than using the mouse.
4. Should allow a user to accomplish all of the tasks without an Internet connection.
5. The module information should be applicable to all NUS Computer Science students without additional programmes (such as Double Degree Programmes).
6. Should allow a user who is relatively familiar with CS module codes to manipulate modules faster using module codes than using module names.
7. The response to any use action should become visible within 1 second.
8. The user interface should be intuitive enough for users who are not IT-savvy
9. The source code should be open source.
10. The product should be free for all NUS CS undergraduate students.
11. Should warn the user that the developers will not be held liable for any failure to graduate within normal candidature period due to the use of the product.

Appendix E: Glossary

Active study plan

The study plan that is currently editable by various commands. Also known as the active plan for short.

CLI

Abbreviation for Command Line Interface, which is a text-based user interface used to view and manage information related to study plans in our application.

Command

An instruction that the user enters into the text input field of our application. A valid command will result in a successful operation on viewing or manipulating the study plan(s).

Commit

A version of a study plan that the user saves to a local file. The user may opt to view or revert to a particular version of any study plan.

Core module

A core module is compulsory for all students in the NUS Computer Science course in order to fulfill the graduation requirements. Such modules include:

- Computer Science Foundation
 - CS1101S Programming Methodology
 - CS1231S Discrete Structures
 - CS2030 Programming Methodology II
 - CS2040S Data Structures and Algorithms
 - CS2100 Computer Organisation
 - CS2103T Software Engineering
 - CS2105 Introduction to Computer Networks
 - CS2106 Introduction to Operating Systems
 - CS3230 Design and Analysis of Algorithms
- IT Professionalism
 - IS1103/X IS Innovations in Organisations and Society
 - CS2101 Effective Communication for Computing Professionals
 - ES2660 Communicating in the Information Age
- Mathematics & Sciences
 - MA1521 Calculus for Computing
 - MA1101R Linear Algebra I
 - ST2334 Probability and Statistics

- One Science Module

Co-requisite

Co-requisites are modules that are to be taken concurrently.

CS

Abbreviation for Computer Science, the study of processes that interact with data and that can be represented as data in the form of programs. In particular, CS here refers to the course for Bachelor of Computing in Computer Science (with Honours) offered by School of Computing (SoC), National University of Singapore (NUS).

Current Semester

The semester in which the user is currently taking modules. All modules taken before the current semester are considered completed.

Default study plan

The recommended study plan for a CS freshman, pre-populated with core modules arranged in their recommended semesters of study.

Elective

Refer to UE.

Feasibility

The feasibility of a study plan, or part of a study plan, refers to whether the following conditions are met:

- All modules are taken after their prerequisites have been taken.
- All modules are not taken together with any of their respective preclusions.
- The user, by following this study plan, satisfies their graduation requirements and will be able to graduate without extending their candidature in NUS.

Focus area

CS modules are organised into Focus Areas of coherent modules according to technical areas of study. A CS Focus Area is satisfied by completing 3 modules from the Area Primaries, with at least one module at 4000-level or above. CS Foundation Modules (CFM) that appear in the Area Primaries can be counted as one of the 3 modules towards satisfying a Focus Area. In this case, a student has to read just two other modules in the Area Primaries to satisfy the Focus Area. The ten Focus Areas are listed below:

- Algorithms & Theory
- Artificial Intelligence
- Computer Graphics and Games
- Computer Security
- Database Systems
- Multimedia Information Retrieval

- Networking and Distributed Systems
- Parallel Computing
- Programming Languages
- Software Engineering

Graduation

To graduate from NUS CS means to complete all the stipulated requirements within the user's candidature period, and finish their studies with a Bachelor's degree.

GUI

Abbreviation for the Graphical User Interface, which allows users to interact with electronic devices through graphical icons and visual indicators as opposed to a Command Line Interface (CLI).

Leave of Absence

Also known as LOA for short. During LOA, students will temporarily stop taking NUS modules for an extended period of time, usually one semester. Students may be granted leave of absence for the following reasons:

- Medical reasons
- Academic reasons
- Personal reasons

Mainstream OS

Windows, Linux, Unix, OS-X.

Mainstream semester

Semesters 1 and 2 in Years 1, 2, 3 and 4. These are the default semesters for a CS single-degree undergraduate. In contrast, a *non-mainstream semester* is a special term (e.g. Y1ST1) or a Year 5 semester (e.g. Y5S1).

Major

An academic major is the academic discipline to which an undergraduate student formally commits. A student who successfully completes all modules required for the major qualifies for an undergraduate degree.

Minor

A Minor programme is a coherent course of study providing significant depth in a certain area outside that of the Major, within or outside the student's department. The modular credit (MC) requirement for a Minor programme should be at least 24MCs, of which up to 8MCs may be used to meet the requirements for both the Minor and a Major or another Minor subject to the agreement of the particular department(s), faculty/faculties or programme(s) hosting the Minor.

Modular credits

The undergraduate and graduate curricula are based on a modular system. Under this system, workloads are expressed in terms of Modular Credits (MCs), and academic performance is

measured by grade points on a 5-point scale.

Module

A module (colloquially *mod*) is a class of a specific topic that generally runs for an entire semester. Each module carries a stipulated number of Modular Credits and requires weekly contact hours for students.

Module code

Each module of study has a unique module code consisting of a two- or three-letter prefix that denotes the discipline, and four digits, the first of which indicates the level of the module (e.g., 1000 indicates a Level 1 module and 2000, a Level 2 module). Modules offered by the Department of Computer Science generally start with CS.

NUS Overseas Colleges

The NUS Overseas Colleges Programme, or NOC for short, is an internship programme with strong emphasis on technology entrepreneurship. Selected candidates will spend either 6 or 12 months with a high-tech start-up and take entrepreneurship courses at a designated partner university. NOC students will be full-time interns and part-time students.

NUS

The National University of Singapore (NUS) is the first autonomous research university in Singapore. NUS is a comprehensive research university, offering a wide range of disciplines, including the sciences, medicine and dentistry, design and environment, law, arts and social sciences, engineering, business, computing and music at both the undergraduate and postgraduate levels. Computer Science (CS) is one of the undergraduate programmes offered by NUS.

Preclusion

A module may also specify certain preclusions. These are modules that have similar emphases and may not be taken together with that particular module.

Prerequisite

Pre-requisites indicate the base of knowledge on which the subject matter of a particular module will be built. Before taking a module, a student should complete any pre-requisite module(s) listed for that particular module. Where pre-requisites are specified, equivalent modules will also be accepted. If in doubt, students should consult the module instructor or the Department academic advisor regarding the acceptable equivalent modules.

Semester

An academic year in NUS consists of two regular semesters, each spanning 13 weeks excluding the recess and reading weeks. In our application, a semester can be either a mainstream semester (see above) or a special semester (usually during summer).

Student

Our application is specifically targeted to students who study Computer Science (CS) in the School of Computing in the National University of Singapore (NUS).

Student exchange programme

The NUS Student Exchange Programme, or SEP for short, provides students with the opportunity to study in an overseas partner university, usually for a semester or two, with approval of the School, to further enhance their learning experience. Students from either partner university pay fees only at their home institution while on exchange.

Study plan

A study plan is an academic plan detailing all modules that a student plans to take in all the semesters in their candidature in NUS. One study plan comprises 8 semesters of modules. The user may have multiple alternative study plans.

S/U

Abbreviation for Satisfactory / Unsatisfactory Options. Sometimes abbreviated as SU. In general, students may exercise the S/U option for up to 32 MCs in the first two regular semesters; if this is not fully utilised, the S/U option may still be exercised in subsequent semesters, for up to 12 MCs. Modules with grades as S/U are not factored into the calculation of students' Cumulative Average Points (CAP). Modules on which the S/U option can be exercised are described as *SU-able*.

Tag

A module can be added a tag or multiple tags, which include the following:

- core module
- UE
- focus area etc

UE

UE stands for Unrestricted Elective. Unrestricted Electives enable students to pursue their academic interests and aspirations. Students may also use Unrestricted Electives to satisfy partially or wholly the requirements of other programmes. As long as the appropriate prerequisites are met, students can satisfy the Unrestricted Electives requirement by taking modules from any of the Departments/Faculties at any level. The limit on the number of Level-1000 modules to be counted towards fulfilment of graduation requirements is 60 MCs for 160-MC programmes. In CS, a student needs to fulfill at least 32 MCs of UEs before graduation.

Valid module

A module is said to be valid if its prerequisites have been fulfilled and none of its preclusions are being taken at the same time as the student takes that particular module.

Year of study

A student's year refers to whether the student is in their first (Y1), second (Y2), third (Y3), fourth (Y4), or fifth (Y5) year of undergraduate studies in NUS.

Appendix F: Instructions for Manual Testing

Given below are instructions to test the app manually.

NOTE

These instructions only provide a starting point for testers to work on; testers are expected to do more *exploratory* testing.

F.1. Launch and Shutdown

1. Initial launch
 - a. Download the jar file and copy into an empty folder
 - b. Double-click the jar file or run `java -jar csmodbuddy.jar` in command prompt (Windows) or terminal (Mac)
Expected: Shows the GUI with a default study plan. The window size may not be optimum.
2. Saving window preferences
 - a. Resize the window to an optimum size. Move the window to a different location. Close the window.
 - b. Re-launch the app by double-clicking the jar file or running `java -jar csmodbuddy.jar` in command prompt/terminal.
Expected: The most recent window size and location is retained.

F.2. Executing basic commands

1. Help
 - a. Test case: `help`
Expected: A list of commands will be displayed, with brief descriptions of what they do.
2. Help specific
 - a. Test case: `help addmod`
Expected: An explanation of the addmod command will be displayed.
3. Autocomplete
 - a. Test case: `remove`, then press `TAB`
Expected: A menu will appear with possible autocompletions that can be selected with up and down keys.
Things in the menu will be: `removealltags`, `removecommit`, `removemod`, `removeplan`, `removepriority`, `removesem`, `removetag`.
 - b. Test case: `ac`, then press `TAB`
Expected: The command box will be filled with `activate`.
4. Undo
 - a. Test case: `undo`
Expected: The previous command will be undone. However, note that `undo` does not work for commands that simply display information, such as `help`, or to commands that alter commits, such as `commit`.
5. Redo
 - a. Test case: `redo`
Expected: The command that was undone will be redone.

F.3. Executing module-related commands

1. Adding a module

a. Prerequisites

- i. Module must be a valid Computer Science core module.
- ii. The current ModulePlanner must have an existing active study plan.
- iii. The active study plan must have the given semester.
- iv. The semester must not be blocked.
- v. Study plan does not have any semester that contains the given module already.

b. Test case: `addmod y2s1 cs2102`

Expected: If there exists an active study plan, the study plan has the given semester and the study plan does not contain any semester that has `CS2102`, then `CS2102` will be added to `Y2S1`. Else, an error message will show according to which criteria it failed.

c. Test case: `addmod y2s1 cs2103 cs2104`

Expected: `CS2103` and `CS2104` will be added to `Y2S1`. Else, an error message will show according to which criteria it failed.

2. Removing a module

a. Prerequisites

- i. Module must be a valid Computer Science core module.
- ii. The current ModulePlanner must have an existing active study plan.
- iii. The active study plan must have the given semester.
- iv. The semester must not be blocked.
- v. Module exists in the given semester.

b. Test case: `removemod cs2102 y2s1`

Expected: If there exists an active study plan, the study plan has the given semester and the semester contains `CS2102`, then `CS2102` will be removed to `Y2S1`. Else, an error message will show according to which criteria it failed.

3. Finding a module

a. Prerequisite

- i. The module must exist in the study plan.

b. Test case: `findmod CS1101S`

Expected: The semester in which CS1101S is located will appear in the left panel.

F.4. Executing semester-related commands

1. Adding a semester

a. Prerequisite

- i. There is at least one study plan. (i.e. There is a current active study plan)

- b. Test case: `addsem y1st1` note that the semester must be a special term or a Year 5 semester
Expected: The semester `Y1ST1` will appear on the right panel of GUI. You can add modules etc to this semester from now on.
- 2. Removing a semester
 - a. Prerequisite
 - i. There is at least one study plan. (i.e. There is a current active study plan)
 - b. Test case 1: `removesem y1st1` note that the semester is a special term or a Year 5 semester in this case
Expected: The semester `Y1ST1` will disappear from the right panel.
 - c. Test case 2: `removesem y1s1` note that the semester is a regular semester in this case
Expected: The semester `Y1S1` will have all its modules cleared. But this semester will still remain on the right panel since it is one of the default semesters.
- 3. Set current semester
 - a. Prerequisites
 - i. The current ModulePlanner must have an existing active study plan.
 - ii. The active study plan must have the given semester.
 - b. Test case: `setcurrent y1s1`
Expected: `Y1S1` will be reflected as the current semester in the GUI. Modules in the previous semesters will have the `Completed` tag assigned to them, and the MC count of the study plan will be updated as well.
- 4. Blocking a semester
 - a. Prerequisites
 - i. The current ModulePlanner must have an existing active study plan.
 - ii. The active study plan must have the given semester.
 - iii. Semester is not blocked.
 - b. Test case: `block y1s1 LOA`
Expected: If there exists an active study plan, the study plan has the given semester, then the semester will be blocked and it will reflect in the GUI as a darker shade of grey. The reason will also be shown.
- 5. Unblocking a semester
 - a. Prerequisites
 - i. The current ModulePlanner must have an existing active study plan.
 - ii. The active study plan must have the given semester.
 - iii. Semester is blocked.
 - b. Test case: `unblock y1s1 LOA`
Expected: If there exists an active study plan, the study plan has the given blocked semester, then the semester will be unblocked and it will reflect in the GUI.

F.5. Executing tagging-related commands

1. Tagging a module

a. Prerequisites

- i. A tag name has to be a single word, less than 25 characters long and not be a default tag name.
- ii. The target module must exist.

b. Test case: `addtag cs1101s exchange`

Expected: If CS1101S is currently in the study plan, a new tag with the name "exchange" can be seen below the module CS1101S. If CS1101S is not in the study plan, add it to the study plan and the tag can be seen attached to it. The tag will also be in the list when `viewalltags` is called.

c. Test case (after (b)): `addtag cs1101s EXCHANGE`

Expected: No new tag is added since CS1101S already has the tag "exchange".

2. Renaming a module tag

a. Prerequisites

- i. The new tag name has to be a single word, less than 25 characters long and not be a default tag name.
- ii. The target tag (e.g. "exchange") must exist in the study plan.

b. Test case: `renametag exchange sep`

Expected: All the tags named "exchange" will be renamed to "sep".

3. Removing a tag from a module

a. Prerequisites

- i. The target tag (e.g. "exchange") must exist in the target module.

b. Test case: `removetag cs1101s exchange`

Expected: The tag will be removed from CS1101S only.

4. Deleting a module tag

a. Prerequisites

- i. The target tag (e.g. "exchange") must exist in the study plan.

b. Test case: `deletetag exchange`

Expected: The tags named "exchange" will be removed from all the modules they are attached to. The tag will not be in the list when `viewalltags` is called.

5. Viewing a module's tags

a. Test case: `viewtags CS1101S`

Expected: A left panel with a list of tags will appear. The tags that are in the list should include the default tags `Core` and `S/U-able`, as well as any other user-created tags that have been added.

6. Removing all tags

a. Test case: `removealltags`

Expected: All user-created tags will be removed from all modules.

7. Viewing all modules tagged with a given tag

a. Prerequisites

i. The tags entered should exist in the study plan.

b. Test case: `viewtagged core s/u-able`

Expected: A left panel with a list of all modules attached with both tags will appear.

8. Viewing all tags

a. Test case: `viewalltags`

Expected: All tags, default and user-created, will appear in the left panel. Default tags have short descriptions attached.

9. Viewing all default tags

a. Test case: `viewdefaulttags`

Expected: All default tags will appear in the left panel.

F.6. Executing study plan-level commands

1. Adding a study plan

a. Test case: `newplan first`

Expected: A study plan with the title `first` is created, and a unique ID is assigned to it.

b. Test case: `newplan`

Expected: A study plan without a title is created, and a unique ID is assigned to it. Note that this ID is unique and will not change throughout the life of the study plan.

2. Deleting a study plan

a. Prerequisite

i. The study plan ID must refer to an existing study plan. You can check this by the `list` command.

b. Test case: `removeplan 1`

Expected: The study plan with the ID `1` will be deleted. To check your study plans' indices, you can use the `list` command. Note that since the IDs are unique, the IDs of the other study plans will not change after the deletion of this plan.

3. Listing all study plans

a. Prerequisite

i. There is at least one study plan.

b. Test case: `list`

Expected: all study plans are listed.

4. Viewing another study plan

a. Prerequisite

i. The study plan ID must refer to an existing study plan. You can check this by the `list` command.

- b. Test case: `viewplan 1`
Expected: The study plan with the ID `1` will be displayed in the left panel as a simplified view.
- 5. Activating another study plan
 - a. Prerequisite
 - i. The study plan ID must refer to an existing study plan. You can check this by the `list` command.
 - b. Test case: `newplan title` then `activate 2` if the new plan's ID is `2`
Expected: The study plan with the ID `2` will be displayed in the left panel as a simplified view.
- 6. Editing the title
 - a. Prerequisite
 - i. There is at least one study plan. (i.e. There is a current active study plan)
 - b. Test case: `title best plan`
Expected: The active study plan (on the right) will have its title changed to `best plan`.
- 7. Setting default study plan
 - a. Test case: `default`
Expected: A new study plan with the title `Recommended Plan` will be created and made active (shown on the right panel). A unique ID will be assigned to this plan too.
- 8. Setting the priority of a study plan
 - a. Prerequisite
 - i. There must be at least one study plan in the module planner.
 - b. Test case: `setpriority high 1`
Expected: If there is a study plan with index `1`, a red priority tag named "PRIORITY.HIGH" will appear next to the study plan title. If the index is invalid, an error message will be shown.
- 9. Removing the priority of a study plan
 - a. Prerequisite
 - i. The target study plan must have a priority tag
 - b. Test case: `removepriority 1`
Expected: If the study plan has a priority tag, it will be removed. If the index is invalid or the study plan does not have a priority tag, an error message will be shown.
- 10. Listing study plans according to their priorities
 - a. Prerequisite
 - i. There are three study plans in the module planner, two set with priorities `low`, `high` and one with no priority.
 - b. Test case: `listbypriority`
Expected: A left panel with a list of study plans sorted in the order such that their priorities are `high`, `low` and no priority.

F.7. Executing version tracking-related commands

1. Committing a study plan

a. Prerequisite

- i. There is at least one study plan. (i.e. There is a current active study plan)

b. Test case: `commit some message`

Expected: The state of the current study plan will be saved and committed. If you enter `history`, you can see this commit with the message `some message`.

2. Checking commit history

a. Prerequisite

- i. There is at least one study plan. (i.e. There is a current active study plan)

b. Test case: `history`

Expected: All the commits of this study plan will be listed. If there are no commits, it will prompt the user that there are no commits currently.

3. Viewing a commit

a. Prerequisite

- i. There is at least one study plan. (i.e. There is a current active study plan). And there is at least one commit in its commit history.

b. Test case: `viewcommit` followed by the commit number e.g. `viewcommit 1.1`. You can check the number using `history`

Expected: The state of the study plan represented by the specified commit will be shown on the left panel as a simplified view.

4. Reverting to a commit

a. Prerequisite

- i. There is at least one study plan. (i.e. There is a current active study plan)
- ii. There is at least one commit in its commit history.

b. Test case: `revert` followed by the commit number e.g. `revert 1.1`. You can check the number using `history`

Expected: The state of the study plan represented by the specified commit will be activated and shown on the right panel of the GUI. If you enter `history`, you will see a new `Revert to ...` commit being newly added to the commit history.

5. Removing a commit

a. Prerequisite

- i. There is at least one study plan. (i.e. There is a current active study plan)
- ii. There is at least one commit in its commit history.

b. Test case: `removecommit` followed by the commit number e.g. `removecommit 1.1`. You can check the number using `history`

Expected: The specified commit will be removed from the commit history permanently. If you enter `history`, you will see that the commit has disappeared. Note that the indices are

based on the position of the commit in the commit list, so all the commit numbers will be shifted forward.

F.8. Executing information and verification-related commands

1. Checking for study plan requirements

a. Prerequisite

- i. There must be an active study plan.

b. Test case: `check`

Expected: The study plan requirements for your current study plan should be checked based on 3 criteria: total MC count of the study plan (both completed and uncompleted), number of core modules taken, and number of focus area primaries taken. The study plan satisfies graduation requirements only if all 3 criteria are met.

2. Describing a module

a. Test case: `description CS1101S`

Expected: It should show the description of CS1101S, including module name, MC count, S/U-ability, prerequisites, and more.

3. Showing focus area primary modules

a. Test case: `showfocus`

Expected: It should show a list of all focus area primary modules in the left panel, regardless of whether they are in the study plan or not.

4. Showing core modules

a. Test case: `showcore`

Expected: It should show a list of all core modules in the left panel, regardless of whether they are already in the study plan or not.

5. Clearing all invalid modules

a. Prerequisite

- i. There should be modules in the right panel that are invalid, in that not all prerequisites have been satisfied.

b. Test case: `clearinvalidmods`

Expected: It should remove all modules that are invalid in the right panel. Note that this can cause new modules to become invalid as well.

6. Show valid modules

a. Test case: `validmods y1s1`

Expected: It should show all valid modules that can be taken in Y1S1. Note that this may include the dissertation and internship, as their prerequisites are not expressible in terms of prerequisite modules.

F.9. Executing GUI-related commands

1. Expanding a semester
 - a. Test case: `expand y1s1` Expected: If Y1S1 was previously collapsed, it should be expanded now. If it was already expanded, no change will occur.
2. Expanding all semesters
 - a. Test case: `expandall` Expected: All semesters should be expanded.
3. Collapsing a semester
 - a. Test case: `collapse y1s1` Expected: If Y1S1 was previously expanded, it should be collapsed now. If it was already collapsed, no change will occur.
4. Collapsing all semesters
 - a. Test case: `collapseall` Expected: All semesters should be collapsed.
5. Changing the theme
 - a. Test case: `theme dark` Expected: The theme will become dark.