Developer Guide

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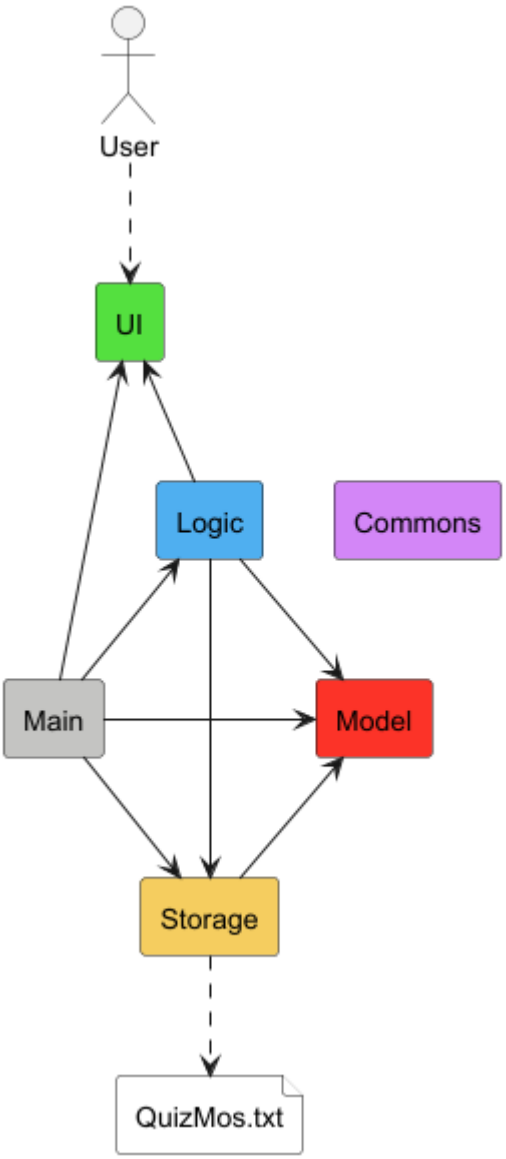
Acknowledgements

- JUnit 5 - For unit testing.
- Gradle - For build automation.
- PlantUML - For creating UML diagrams.

Design

Architecture



The ***Architecture Diagram*** given above explains the high-level design of the App.

- `Main` : Launch app and shut down
  - At app launch, it initializes the other components in the correct sequence, and connects them up with each other.

    - At shut down, it shuts down the other components.
- `UI` : The UI of the App, in charge of print out information in format.
- `Logic` : The Command parser and executor.
- `Model` : Stores data of the App in memory.
- `Storage` : Reads data from, and writes data to, the hard disk.

The sections below give more details of each component

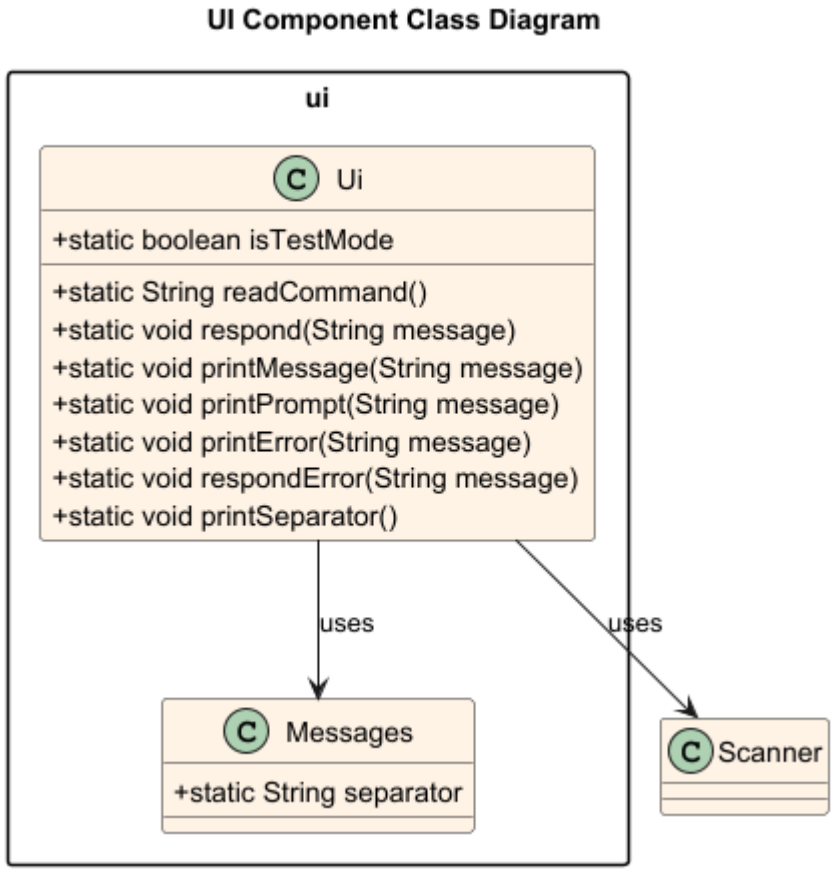
UI Component

Responsibilities:

- Handles all user interactions via the console.
- Reads user input commands for processing by the `Logic` component.
- Displays formatted messages, prompts, separators, and errors.
- Provides a test mode for automated testing where ANSI colors are disabled.
- Interacts with `Flashcard` objects from the `Model` component to display data.

Classes:

- `Ui` : Provides methods to read user input, display messages, prompts, errors, and separators. Supports both normal and test modes for consistent UI behavior.
- `Messages` : Stores common string messages and separators used across the UI for consistent formatting and display.



Logic Component

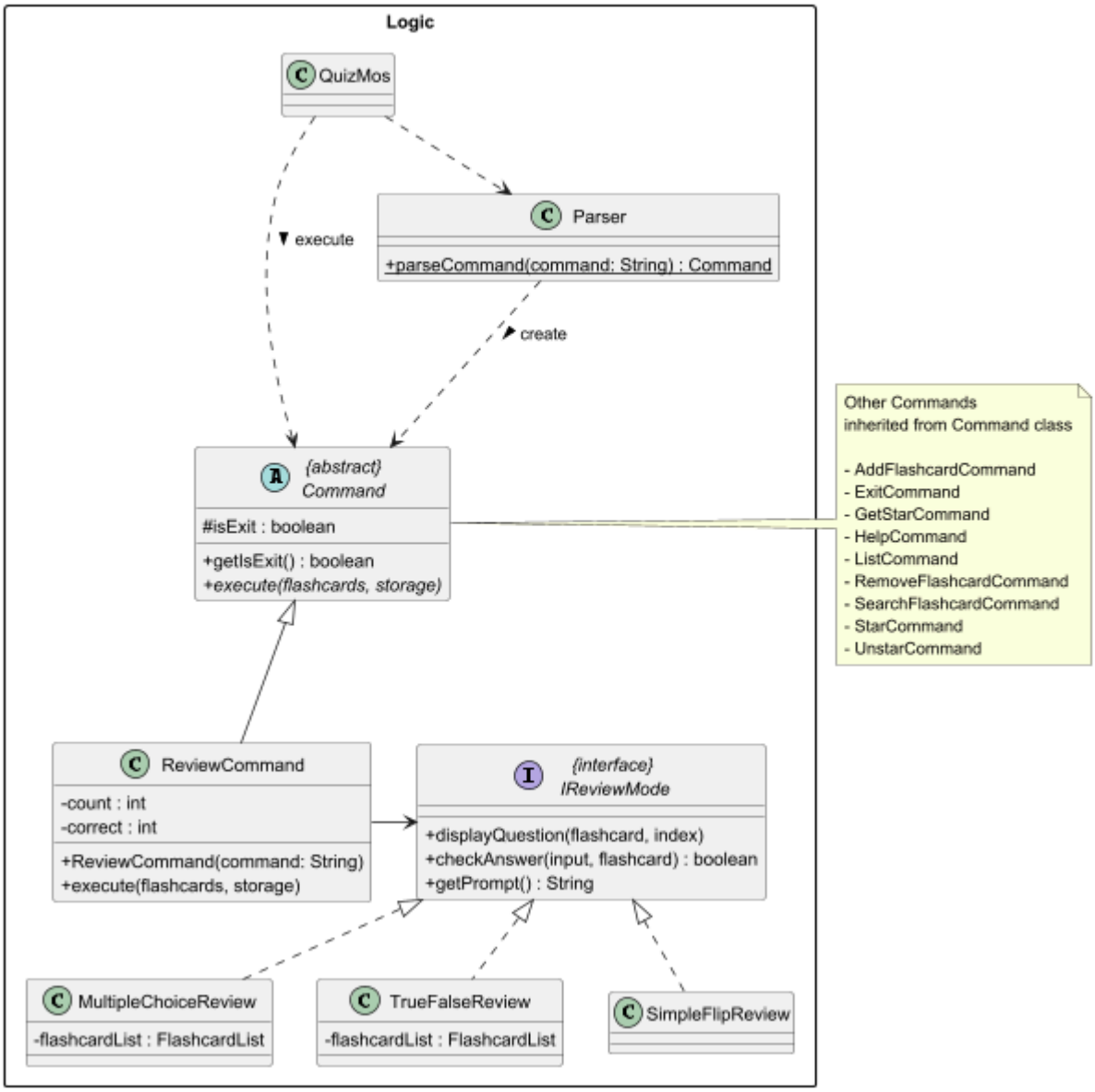
Responsibilities:

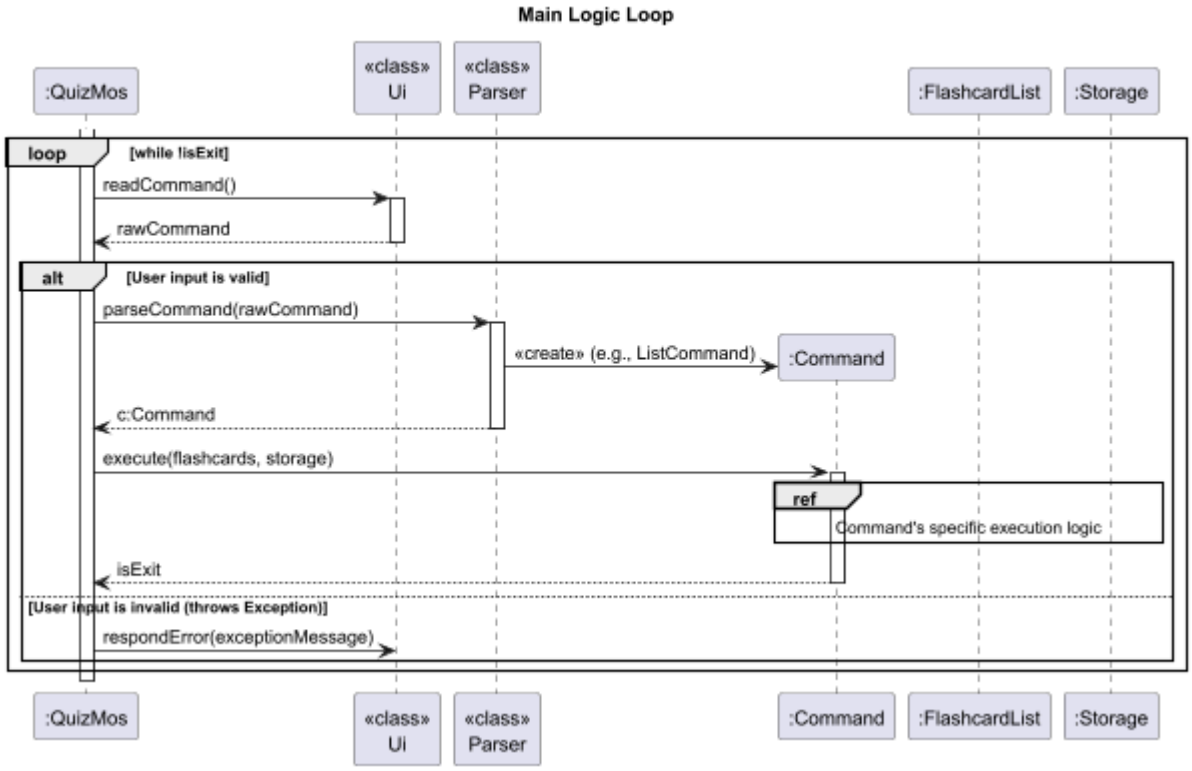
- Run the main application loop, handling continuous command input.
- Parse the raw command, then execute the resulting Command object.
- Catch and handle exceptions thrown during command parsing or execution.
- Execute `Command` objects to indirectly interact with the Model (`FlashcardList`).

Classes:

- `QuizMos` : Runs the main loop, reads user input from UI, sends the raw command to Parser, and executes the returned Command object.
- `Parser` : Parses the raw input string, validates format, extracts arguments, and returns the appropriate concrete Command object, or throws a specific exception.
- `Command` : Abstract class for other command classes
  - `AddFlashcardCommand`
  - `ExitCommand`
  - `GetStarCommand`
  - `HelpCommand`
  - `ListCommand`
  - `RemoveFlashcardCommand`
  - `ReviewCommand`
  - `SearchFlashcardCommand`
  - `StarCommand`
  - `UnstarCommand`
- `IReviewMode` : Interface for different review modes
  - `MultipleChoiceReview`
  - `SimpleFlipReview`
  - `TrueFalseReview`

Logic Component





Model Component

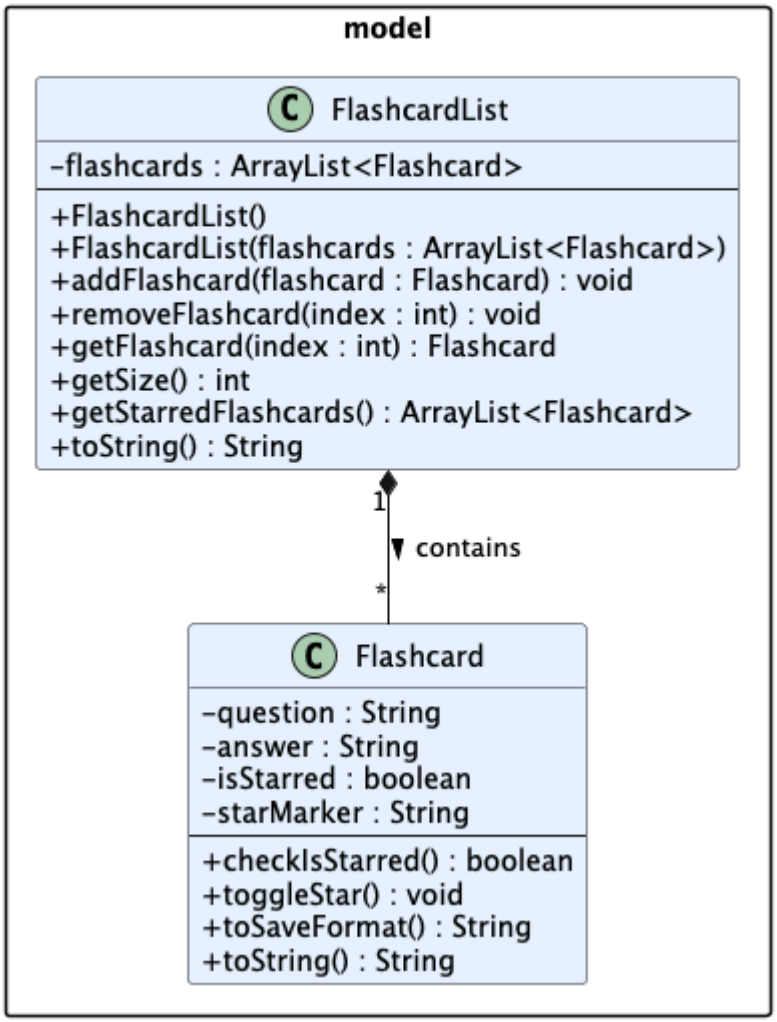
Responsibilities:

- Manages the in-memory representation of flashcards.
- Provides methods to add, delete, and search flashcards.

Classes:

- `Flashcard` — Represents a single flashcard containing a question and answer pair, with support for marking it as starred.
- `FlashcardList` — Manages a collection of flashcards, providing methods to add, remove, retrieve, and list flashcards, as well as filter starred ones.

Model Component Class Diagram



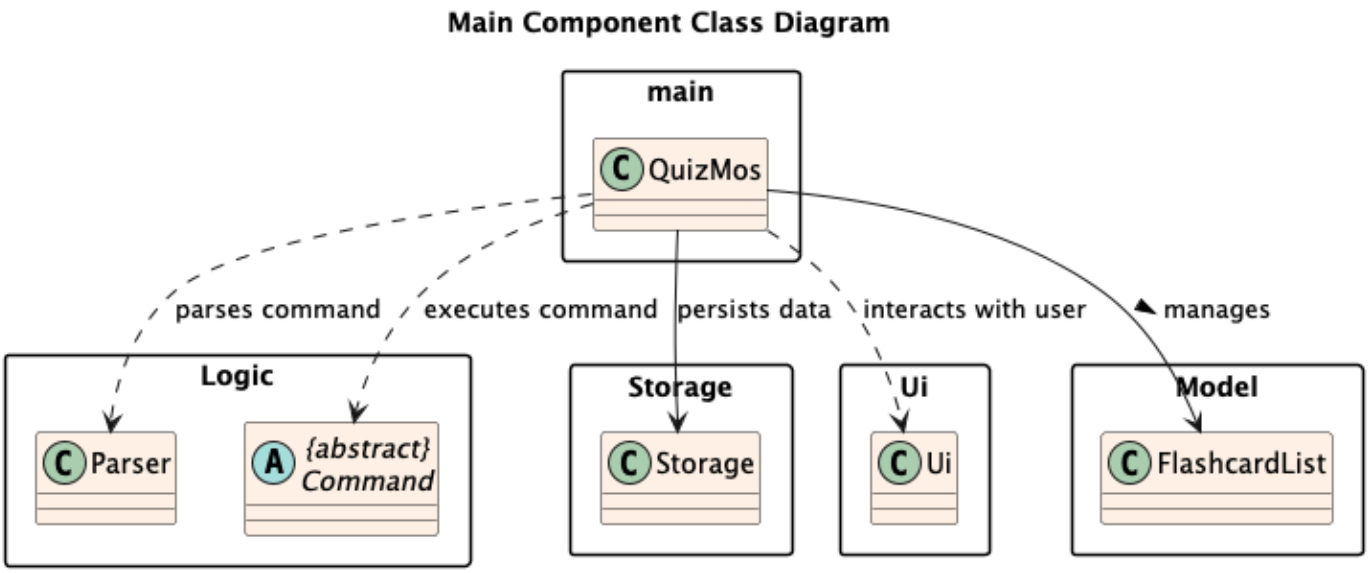
Main Component

Responsibilities:

- Initializes the application.
- Coordinates between UI, Logic, and Storage components.

Class:

- `QuizMos` — The main entry point of the application. Handles setup, command parsing, and orchestrates the overall program flow.



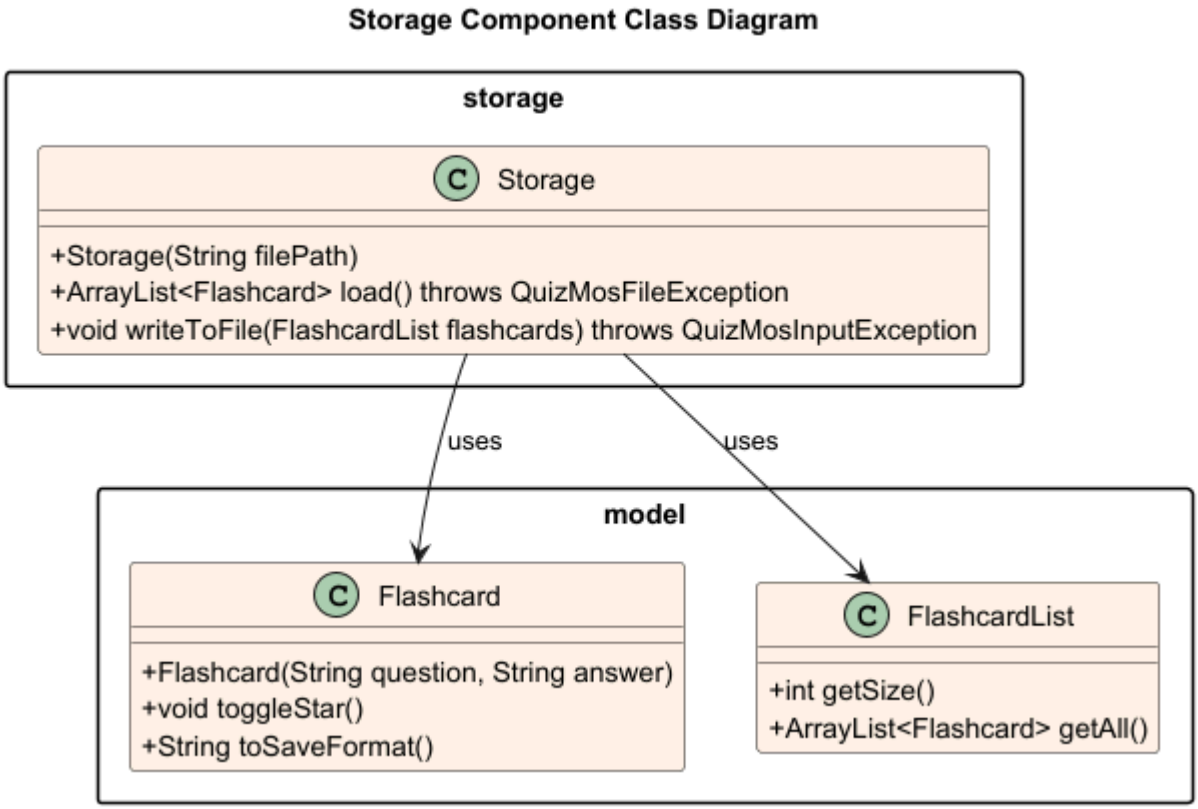
Storage Component

Responsibilities:

- Reads flashcard data from the storage file into memory.
- Writes updated flashcard data from memory back to the storage file.
- Ensures that the storage file and its parent directories exist, creating them if necessary.
- Handles file-related exceptions and logs operations for debugging purposes.
- Works with `Flashcard` and `FlashcardList` objects from the `Model` component.

Classes:

- `Storage` : Manages persistence of flashcards; reads from and writes to the storage file, ensures file existence, handles exceptions, and interacts with `Flashcard` and `FlashcardList` .



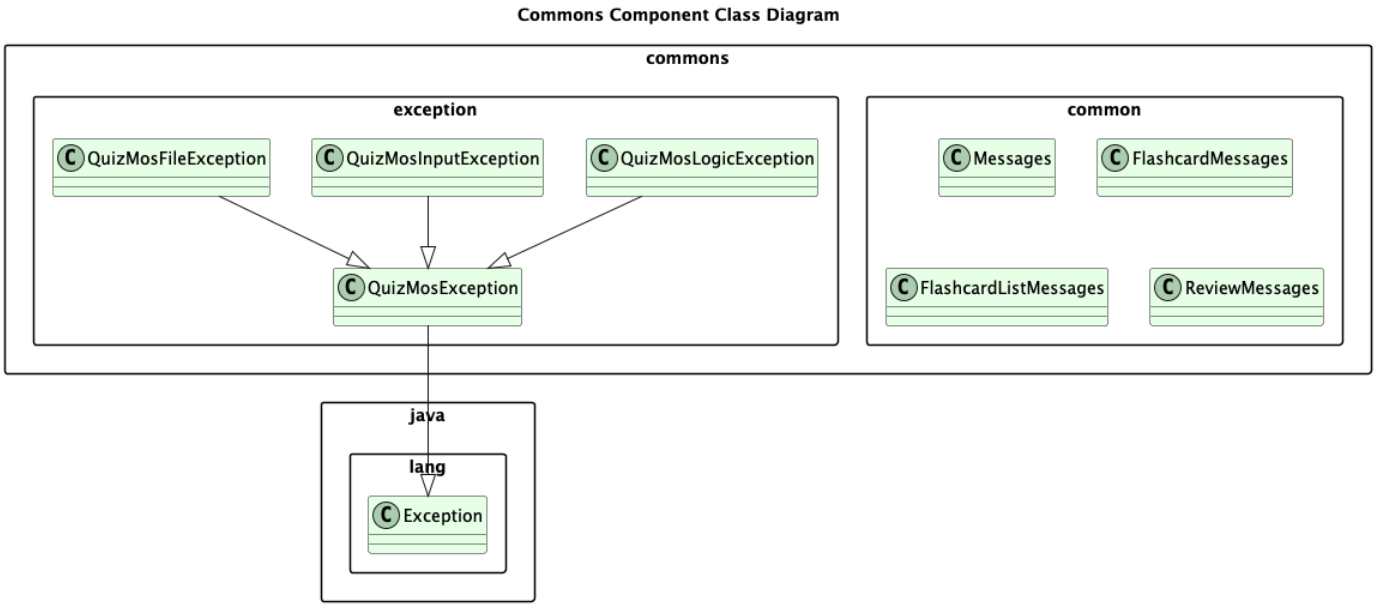
Commons Component

Responsibilities:

- Contains shared classes used by multiple components (e.g., Messages, Exceptions).

Class:

- `QuizMosException` — The base exception class for all application-specific errors.
- `QuizMosFileException` — Thrown when file read/write operations fail.
- `QuizMosInputException` — Thrown when user input is invalid or cannot be processed.
- `QuizMosLogicException` — Thrown when logical errors occur during command execution.
- `Messages` — Stores general UI and command-related messages.
- `FlashcardMessages` — Provides user-facing messages for flashcard-related operations.
- `FlashcardListMessages` — Contains messages related to the flashcard list state.
- `ReviewMessages` — Provides messages and prompts used during the flashcard review sessions.



Implementation

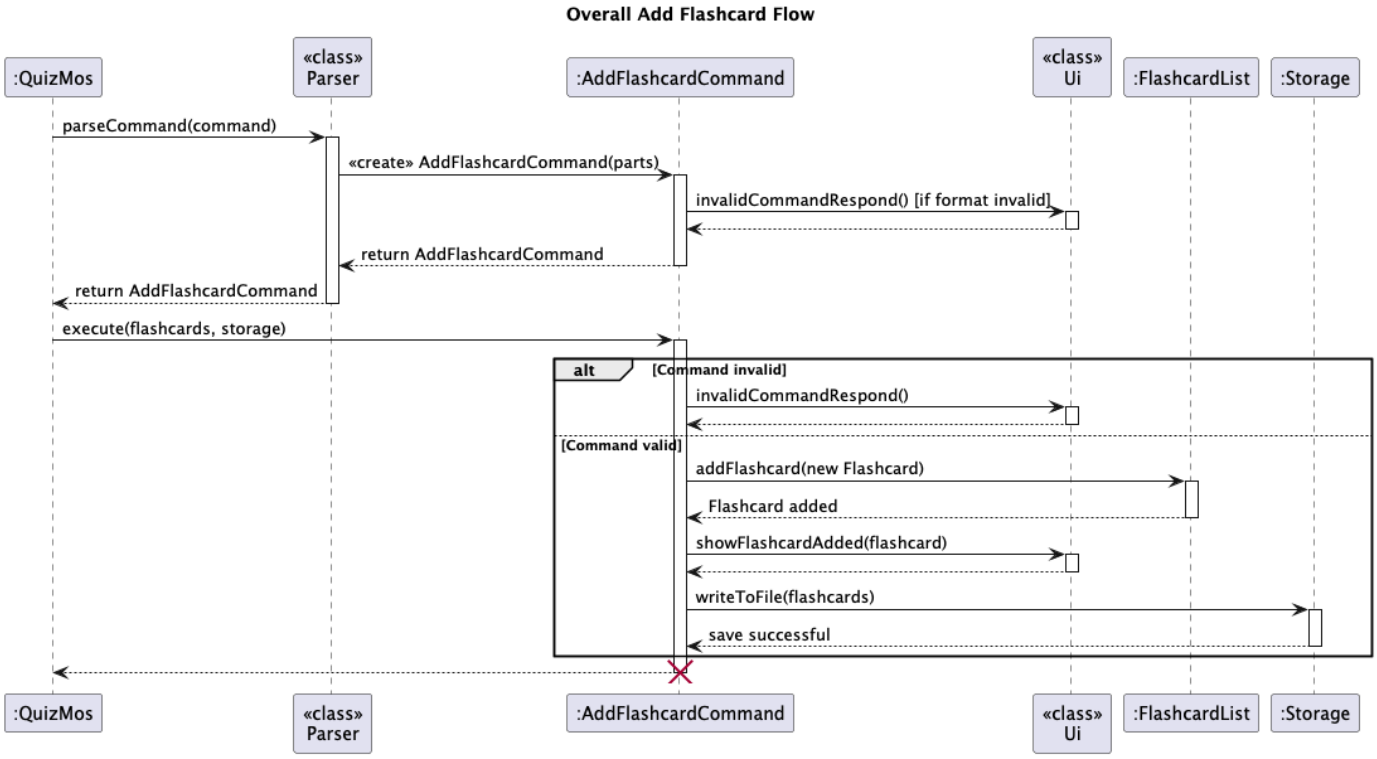
This section describes some noteworthy details on how certain features are implemented.

Feature 1: Add Flashcard

Command: `add q/<question> a/<answer>`

Explanation:

- The `Parser` identifies the add command and creates a new `AddFlashcardCommand`.
- The `AddFlashcardCommand` parses the user input.
- Validates that both question and answer fields are valid.
- Adds a new flashcard to the `FlashcardList` and saves it via `Storage`.
- Calls the `Ui` to display the flashcard was added.

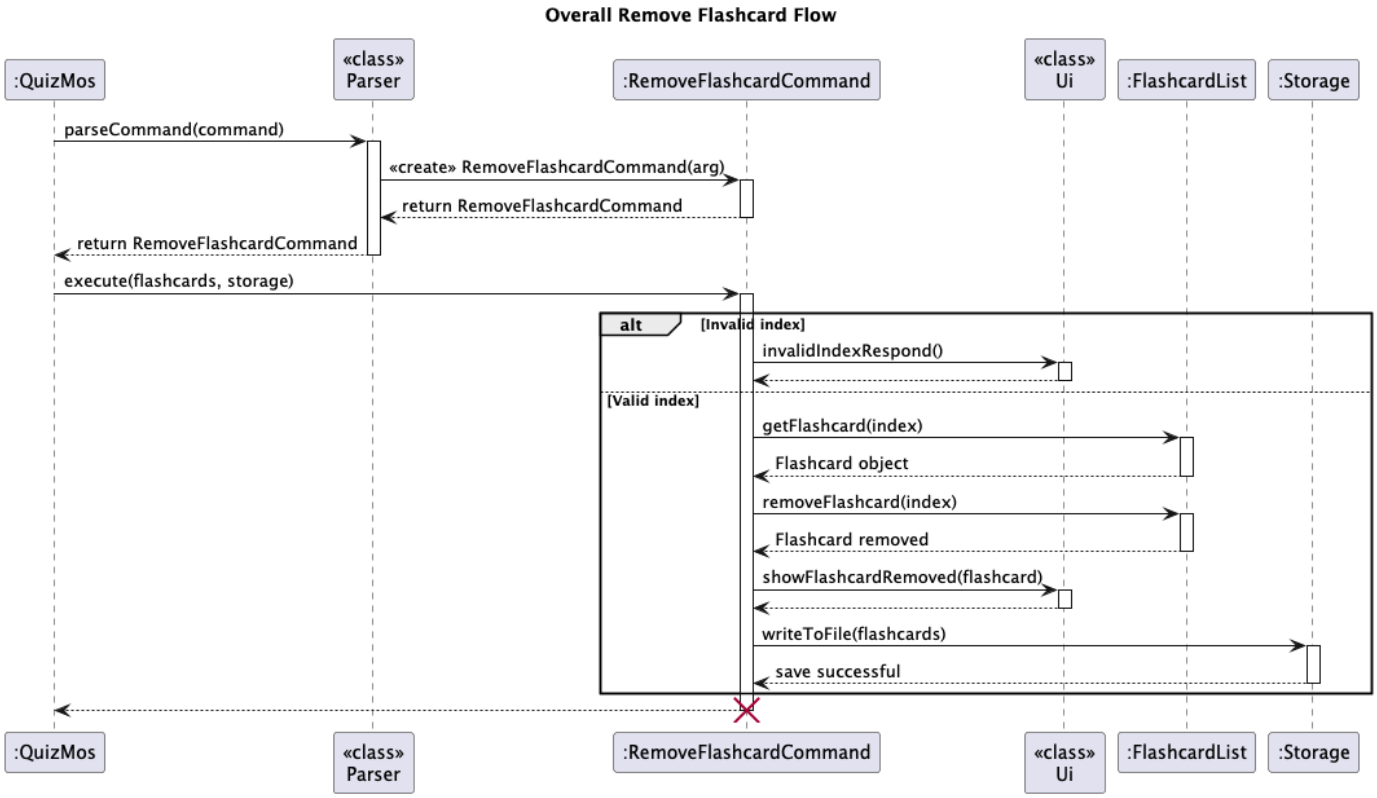


Feature 2: Delete Flashcard

Command: `delete <index>`

Explanation:

- The `Parser` identifies the delete command and creates a new `RemoveFlashcardCommand` .
- The `RemoveFlashcardCommand` parses the user input.
- Validates that the index is valid.
- Removes the flashcard and updates the `FlashcardList` .
- Calls the `Ui` to display the flashcard was removed.

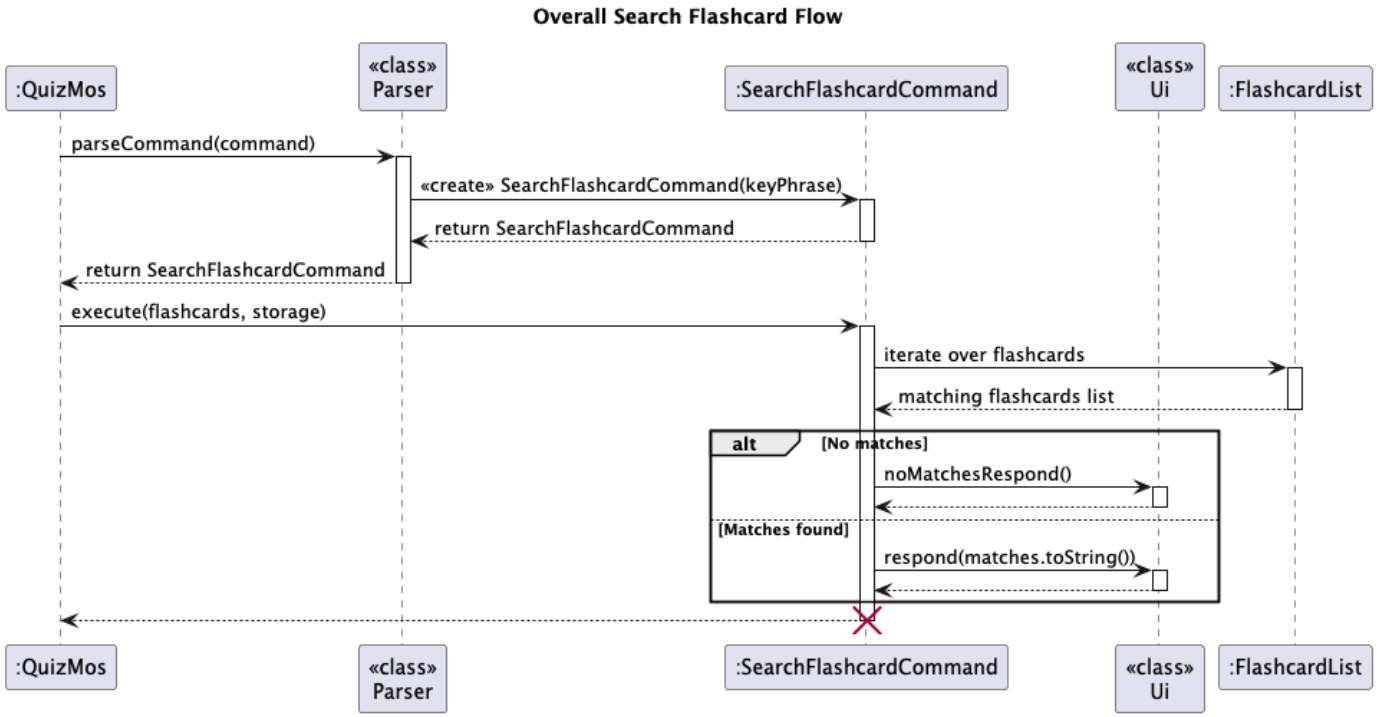


Feature 3: Search Flashcard

Command: `search <keyphrase>`

Explanation:

- The `Parser` identifies the search command and creates a new `SearchFlashcardCommand` .
- The `SearchFlashcardCommand` parses the user input.
- Validates that the keyphrase is valid.
- Searches through all flashcards for matching keywords in question or answer.
- Displays a list of matches or an error if none are found.

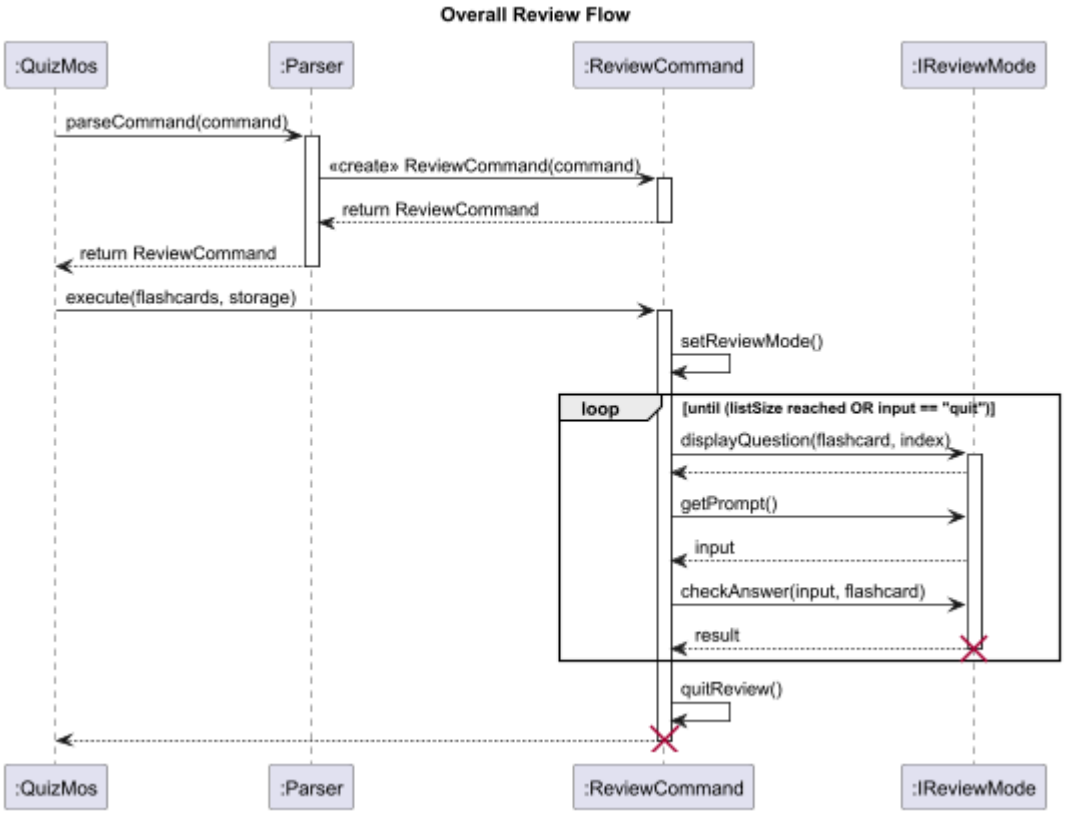


Feature 4: Review Flashcards

Command: `review m/[FLIP \| TF \| MCQ]`

Explanation:

- The `Parser` instantiates `ReviewCommand`, which immediately parses and validates the mode from the user's input.
- The `execute()` method first verifies the `FlashcardList` isn't empty. It then calls `setReviewMode()` to dynamically create and assign the correct review object (e.g., `MultipleChoiceReview`) for the review mode.
- The `reviewLoop()` iterates through the flashcards, performing three actions per card via the `reviewMode` object:
  i. Display: Shows the question (mode-specific formatting included).
  ii. Input: Retrieves the user's answer (or breaks the loop if the input is `quit`).
  iii. Resolution: Checks the answer via `checkAnswer()` and updates the correct counter.
- Eventually, the `quitReview()` method displays the session summary, including total cards reviewed and final results (for non-flip modes).



- **Flip mode flow**
  - The App displays the question only.
  - The user is prompted (y/n) to reveal the answer.
  - `checkAnswer()` simply prints the answer if the user input is 'y'. No score tracking is done, as the user dictates correctness.
- **MCQ mode flow**
  - `displayQuestion()` first calls the `listOfChoices()` helper method. This method generates a list of four unique random indices (include the correct one).
  - The App tracks the correct answer's index internally.
  - `checkAnswer()` checks the user's input (1–4) against the internal correct index and updates the score.
- **TF mode flow**
  - `displayQuestion()` presents the flashcard's question paired with an answer that is randomly selected from the entire `FlashcardList`.
  - `currentAnswer` is set to `true` (default is `false`) if the random answer matches the correct answer.
  - The user inputs `t` or `f`. `checkAnswer()` compares the user's input with the pre-determined `currentAnswer` boolean to evaluate correctness and updates the score.

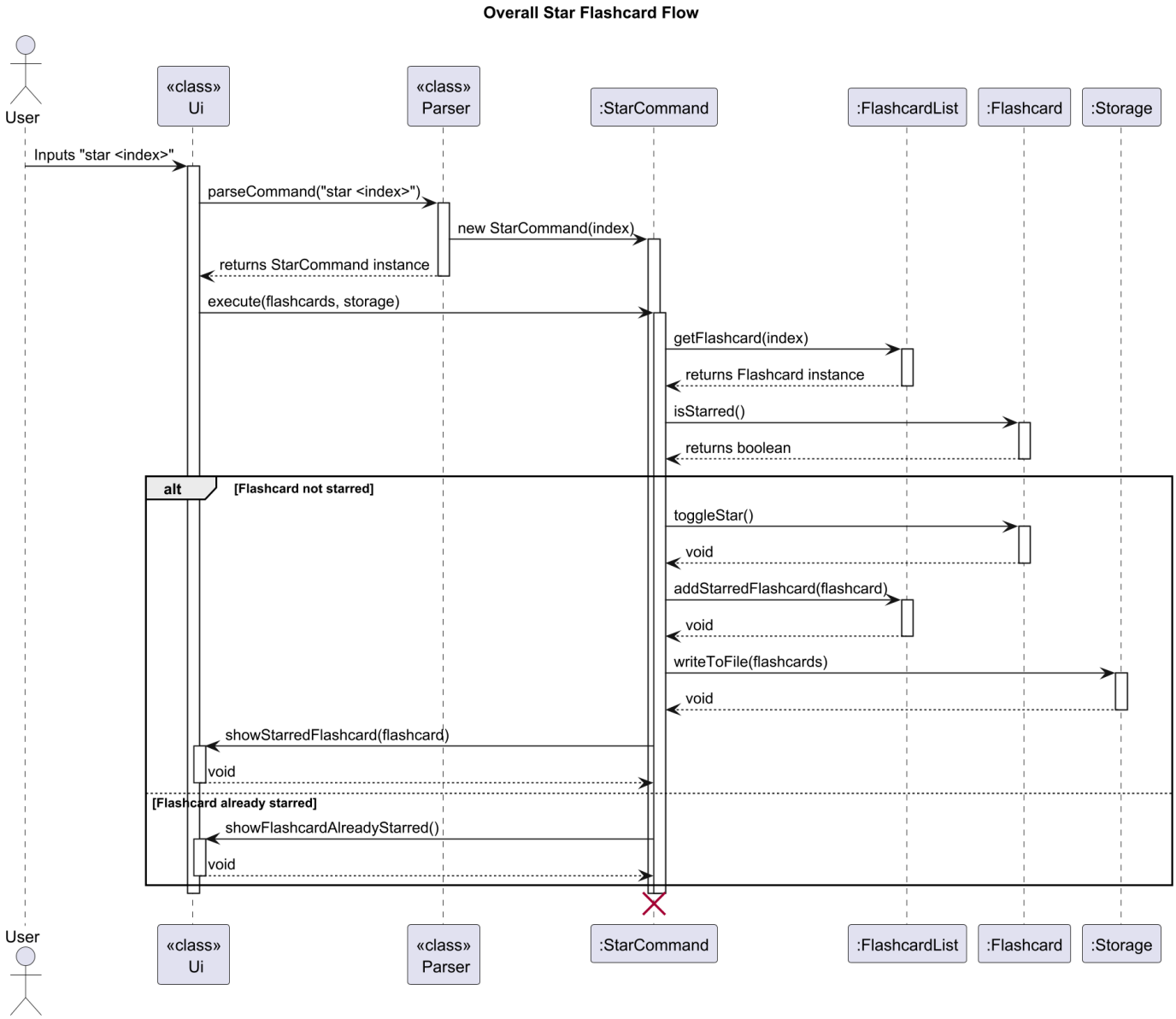
Feature 5: Star Flashcard

Command: `star <index>`

Explanation:

- The `Parser` identifies the `star` command and creates a new `StarCommand` object.
- The `StarCommand` parses the user input and converts the provided index to a zero-based integer.
- Validates that the index is within the range of existing flashcards in the `FlashcardList`.

- Retrieves the corresponding `Flashcard` object using the validated index.
- Checks if the flashcard is already starred. If yes, an error is raised through `QuizMosInputException`.
- If not starred, the command toggles its starred status via `toggleStar()` and adds it to the list of starred flashcards.
- Displays a confirmation message using the `Ui` component, leveraging `FlashcardMessages` for consistent formatting.
- Persists the updated `FlashcardList` to storage using the `Storage` component.
- Logs key execution steps (validation, starring, saving) for debugging and traceability.



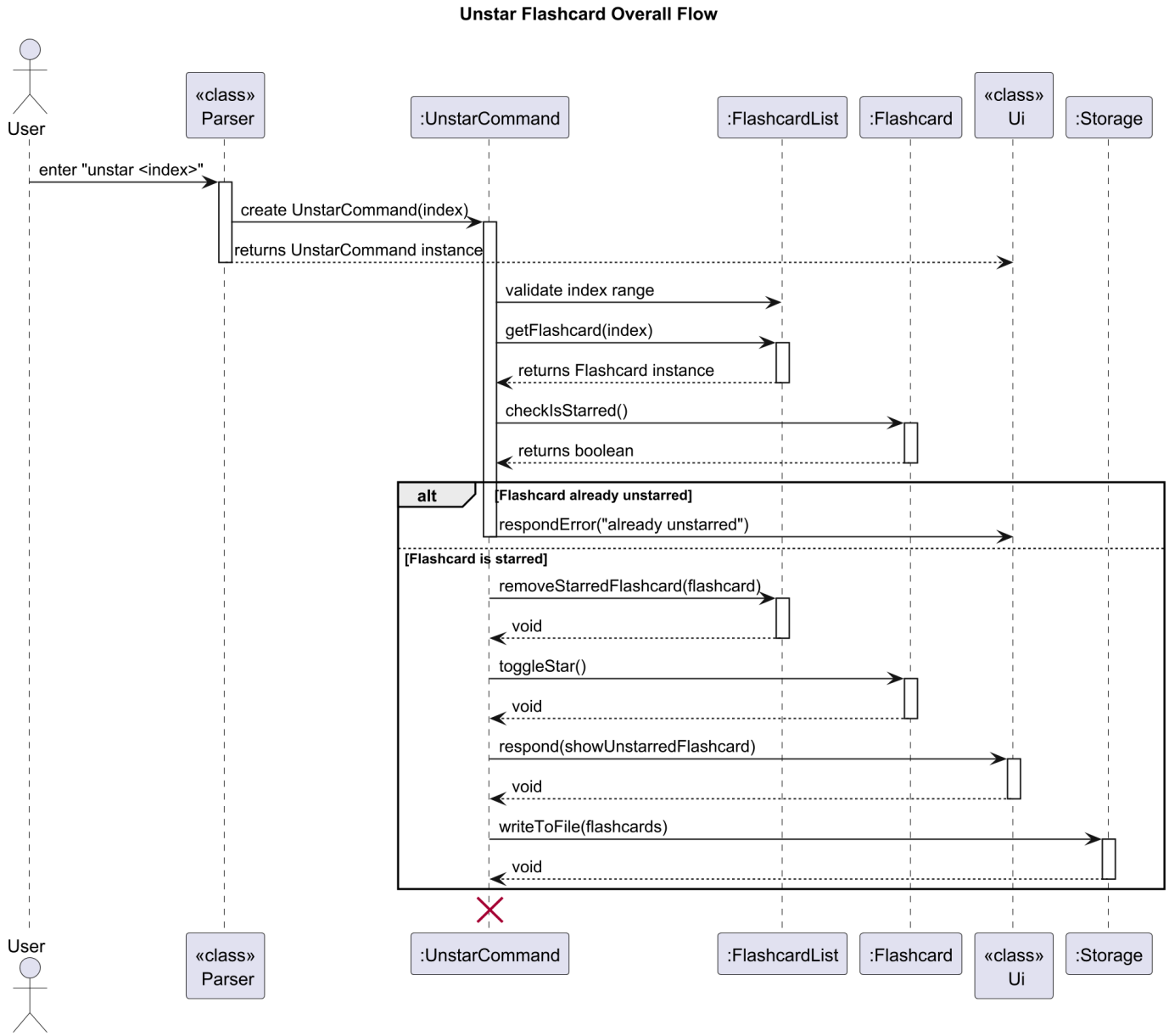
Feature 6: Unstar Flashcard

Command: `unstar <index>`

Explanation:

- The `Parser` identifies the `unstar` command and creates a new `UnstarCommand` object.
- The `UnstarCommand` parses the user input and converts the provided index to a zero-based integer.

- Validates that the index is within the range of existing flashcards in the `FlashcardList`.
- Retrieves the corresponding `Flashcard` object using the validated index.
- Checks if the flashcard is already unstarred. If yes, an error is raised through `QuizMosInputException`.
- If starred, the command toggles its starred status via `toggleStar()` and removes it from the list of starred flashcards.
- Displays a confirmation message using the `Ui` component, leveraging `FlashcardMessages` for consistent formatting.
- Persists the updated `FlashcardList` to storage using the `Storage` component.
- Logs key execution steps (validation, unstarring, saving) for debugging and traceability.



Feature 7: Get Starred Flashcards

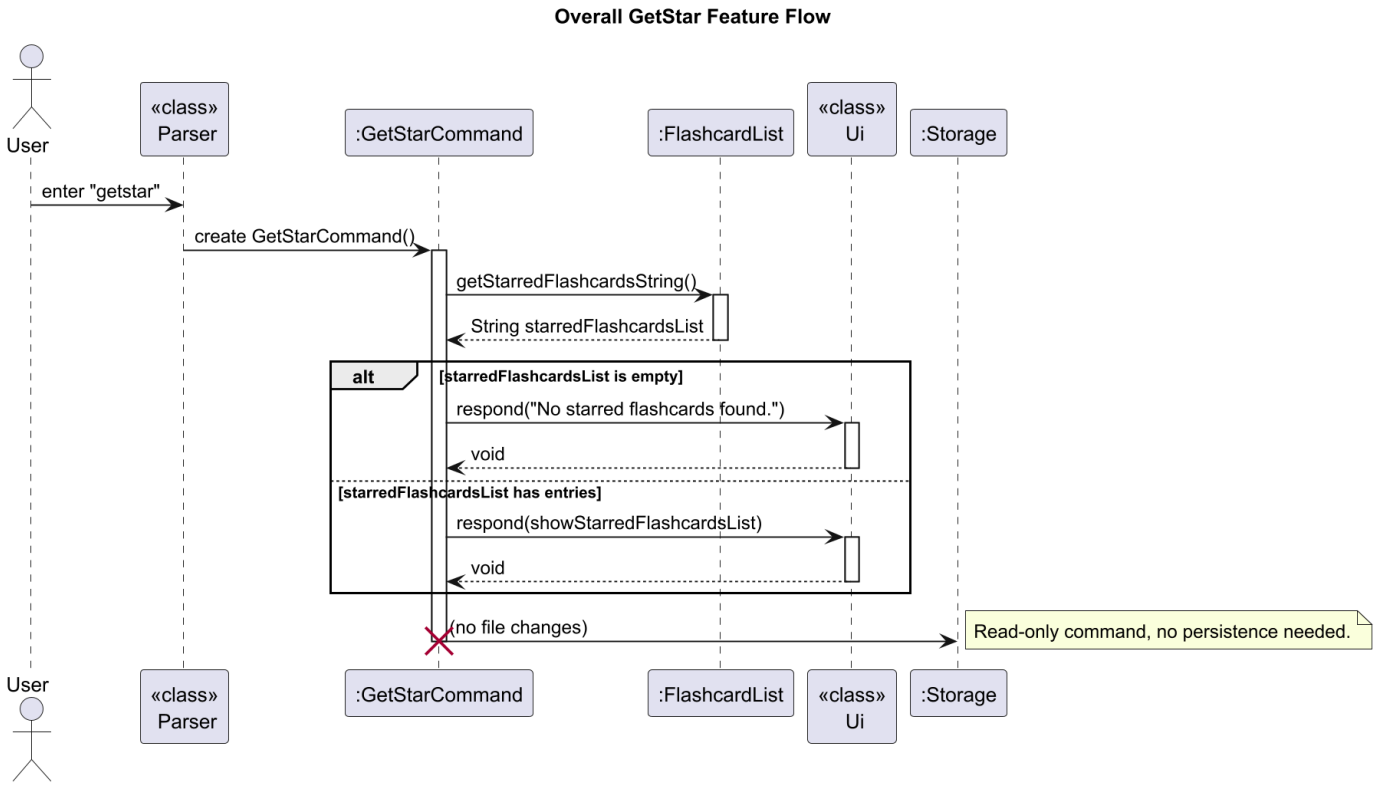
Command: `getstar`

Responsibilities / Explanation:

- The `Parser` identifies the `getstar` command and creates a new `GetStarCommand` object.
- The `GetStarCommand` retrieves all starred flashcards from the `FlashcardList` using `getStarredFlashcardsString()`.
- Performs internal assertions to ensure the returned string is not `null`.
- Uses the `Ui` component to display the list of starred flashcards via `FlashcardListMessages.showStarredFlashcardsList()`.
- Does not modify the `FlashcardList` or `Storage`; this is a read-only command.
- Logs key execution steps for debugging and traceability.

Classes:

- `GetStarCommand`
- `FlashcardList`
- `Ui`
- `FlashcardListMessages`
- `Storage` (reference only, no writes)



Requirements

User Stories

Version	As a...	I want to...	So that I can...
v1.0	new	go through a series of instructions	refer to them when I forget how to use the

Version	As a...	I want to...	So that I can...
	user		application
v1.0	new user	see usage instructions	I know how to use the app
v1.0	user	view list of flashcards overall	I can see every flashcard created
v1.0	user	remove flashcards	I can keep my deck organized and make sure unnecessary cards are removed
v1.0	user	add a flashcard with a question and answer	I can revise the material later
v1.0	user	save my flashcards locally	I can reuse flashcards
v1.0	user	do review	I can review my knowledge
v2.0	user	find a to-do item by name	locate a to-do without having to go through the entire list
v2.0	user	star/flag flash cards which are important	I can review by categories
v2.0	new user	add the list of flashcards through a txt file	I start using the app more quickly
v2.0	user	add multiple choice type questions	I can test my knowledge in different ways
v2.0	user	add true/false type questions	I can test my knowledge in different ways
v2.0	user	search for a specific flashcard by keyword	I can quickly find and revise a concept
v2.0	user	mark my answers as correct or incorrect during quizzes	the app can track my progress

Use Cases

(For all use cases below, the System is QuizMos and the Actor is the User, unless specified otherwise.)

Use case: Add a Flashcard (`add` **)**

Goal: User adds a new question and answer pair to the study list. **Command:** `add q/QUESTION a/ANSWER`

MSS (Main Success Scenario)

1. User requests to add a flashcard with a valid question and answer.
2. QuizMos creates the new Flashcard object.
3. QuizMos adds the Flashcard to the `FlashcardList` and saves the updated list to storage.
4. QuizMos displays a confirmation message showing the new Flashcard details. Use case ends.

Extensions

- 1a. User forgets question or answer (`q/` or `a/` missing or empty).
- 1a1. QuizMos displays an input error message. Use case ends.

Use case: Delete a Flashcard (`delete`)

Goal: User removes a specific flashcard from the study list. **Command:** `delete INDEX`

MSS (Main Success Scenario)

1. User requests to delete a specific flashcard by providing a valid index.
2. QuizMos removes the Flashcard from the `FlashcardList` .
3. QuizMos saves the updated list to storage.
4. QuizMos displays a confirmation message showing the deleted Flashcard. Use case ends.

Extensions

- 1a. The given index is invalid (e.g., negative, non-numeric, or out of range).
- 1a1. QuizMos displays an error message. Use case resumes at step 1.

Use case: Start a Review Session (`review`)

Goal: User tests their memory using a specific review mode (FLIP, TF, or MCQ). **Command:** `review m/[FLIP | TF | MCQ]`

MSS (Main Success Scenario)

1. User requests to start a review session with a valid mode.
2. QuizMos initializes the correct review strategy object (`IReviewMode`).
3. **(Loop)** QuizMos iterates through the list, displays the question (mode-specific format).
4. User inputs an answer (`y/n` , `t/f` , `1-4`) or `quit` .
5. QuizMos processes the input, checks the answer (if applicable to mode), updates the score, and displays feedback.
6. **(Loop)** QuizMos repeats from step 3 for the next flashcard.
7. Review session ends (all cards reviewed).
8. QuizMos displays a summary including total reviewed and score (for non-FLIP modes). Use case ends.

Extensions

- 1a. The `FlashcardList` is empty.
- 1a1. QuizMos displays an error message (*Review list is empty*). Use case ends.
- 1b. MCQ mode requested, but less than 4 flashcards exist.
- 1b1. QuizMos displays an error message (*MCQ requires at least 4 flashcards*). Use case ends.
- 4a. User inputs `quit` at any time.
- 4a1. QuizMos jumps to step 7 (display summary of cards reviewed so far). Use case ends.
- 4b. User inputs an invalid format/choice for the current mode. 4b1. QuizMos displays an input error and repeats step 4. Use case resumes at step 4.

Use case: Star a Flashcard (`star`)

Goal: User marks a flashcard as important or difficult. **Command:** `star INDEX`

MSS (Main Success Scenario)

1. User requests to star a flashcard by providing a valid index.
2. QuizMos retrieves the Flashcard and updates its status to **starred**.
3. QuizMos updates the list of starred Flashcards and saves the changes to storage.
4. QuizMos displays a confirmation message for the starred Flashcard. Use case ends.

Extensions

- 1a. The given index is invalid (e.g., out of range).
- 1a1. QuizMos displays an error message. Use case resumes at step 1.
- 2a. The Flashcard at the given index is already starred.
- 2a1. QuizMos displays a warning message. Use case ends.

Use case: Unstar a Flashcard (`unstar`)

Goal: User removes the important/starred flag from a flashcard. **Command:** `unstar INDEX`

MSS (Main Success Scenario)

1. User requests to unstar a flashcard by providing a valid index.
2. QuizMos retrieves the Flashcard and updates its status to **unstarred**.
3. QuizMos removes the Flashcard from the list of starred Flashcards and saves the changes to storage.
4. QuizMos displays a confirmation message for the unstarred Flashcard. Use case ends.

Extensions

- 1a. The given index is invalid. 1a1. QuizMos displays an error message. Use case resumes at step 1.
- 2a. The Flashcard at the given index is not currently starred.
- 2a1. QuizMos displays a warning message. Use case ends.

Use case: Retrieve Starred Flashcards (`getstar`)

Goal: User views only the flashcards they have marked as important. **Command:** `getstar`

MSS (Main Success Scenario)

1. User requests to retrieve all starred flashcards.
2. QuizMos retrieves the list of starred Flashcards from the `FlashcardList` .
3. QuizMos displays the list of starred flashcards. Use case ends.

Extensions

- 2a. The list of starred flashcards is empty.
- 2a1. QuizMos displays a message indicating that there are no starred flashcards. Use case ends.

Use case: Search Flashcards (`search`)

Goal: User finds flashcards containing a specific keyword or keyphrase. **Command:** `search KEYPHRASE`

MSS (Main Success Scenario)

1. User requests to search the list by providing a valid keyphrase.
2. QuizMos searches through all flashcards for matches in both the question and answer fields.
3. QuizMos displays a list of the matching flashcards. Use case ends.

Extensions

- 1a. The keyphrase is empty.
- 1a1. QuizMos displays an error message (*Keyphrase cannot be empty*). Use case ends.
- 3a. No flashcards match the provided keyphrase.
- 3a1. QuizMos displays a message indicating no matches were found. Use case ends.

Use case: List All Flashcards (`list`)

Goal: User gets an overview of all flashcards in the study list. **Command:** `list`

MSS (Main Success Scenario)

1. User requests to list all flashcards.
2. QuizMos retrieves the entire `FlashcardList` .
3. QuizMos displays the full list of flashcards, including their index and star status. Use case ends.

Extensions

- 2a. The `FlashcardList` is empty.
- 2a1. QuizMos displays a message indicating that the list is currently empty. Use case ends.

Use case: View Help (`help`)

Goal: User gets usage instructions for all commands. **Command:** `help`

MSS (Main Success Scenario)

1. User requests help.
2. QuizMos displays a list of all available command formats and their descriptions. Use case ends.

Extensions (None)

Use case: Exit Application (`exit`)

Goal: User closes the application safely. **Command:** `exit`

MSS (Main Success Scenario)

1. User requests to exit the application.
2. QuizMos saves the current `FlashcardList` to storage (if any unsaved changes exist).
3. QuizMos displays a farewell message.
4. The application terminates gracefully. Use case ends.

Extensions (None)

Non-Functional Requirements (NFRs)

- The display of the next question and answer resolution must occur within 500 milliseconds per card.
- The App must prevent the start of any review session if the `FlashcardList` is empty, throwing an appropriate exception.
- The application must prohibit starting MCQ review if the `FlashcardList` contains fewer than 4 flashcards.
- All review mode prompts must perform immediate input validation and provide clear, specific error messages for incorrect choices.
- The review session must guarantee a graceful exit upon receiving the `quit` command, regardless of the user's progress in the loop.

Glossary

- **FLIP mode:** A basic mode where the user views the question and manually chooses whether or not to reveal the answer.
- **MCQ mode (Multi-choice questions):** A mode that presents the user with four answer choices (including the correct one), forcing them to select one number. Requires at least four flashcards in the list.
- **TF mode:** A mode where a flashcard's question is paired with a randomly selected answer (which may or may not be correct). The user must decide if the resulting statement is true or false.

Instructions for Manual Testing

Launching the Application

Prerequisites

- Java 17 or higher installed.
- `quizmos.jar` is placed in a working directory.

Steps

1. Download the file `quizmos.jar` .
2. Open the terminal.
3. Navigate (`cd`) to the directory containing `quizmos.jar` .
4. Run:

```
java -jar quizmos.jar
```

Below are basic manual test cases for each feature, including correct usage and common edge cases.

Add Command

Correct Cases

- `add q/What is 2+2? a/4`
- `add q/Capital of France a/Paris`

Edge Cases

- `add q/OnlyQuestion` (missing answer)
- `add a/OnlyAnswer` (missing question)
- `add q/ a/` (empty fields)

List Command

Correct Case

- `list`

Edge Cases

- Run `list` when no flashcards exist (should show “No flashcards found”)

Delete Command

Correct Case

- `delete 1`

Edge Cases

- `delete 0`
- `delete 9999` (index out of range)
- `delete abc` (invalid input)

Search Command

Correct Cases

- `search 4`
- `search France`

Edge Cases

- `search` (no keyword)
- `search` (empty keyword)
- `search xyz` (no matches)

Review Command

Correct Cases

- `review m/FLIP`
- `review m/TF`
- `review m/MCQ`

Edge Cases

- `review` (missing mode)
- `review m/INVALID` (invalid mode)
- `review m/MCQ` when fewer than 4 flashcards exist

Star Command

Correct Case

- `star 1`

Edge Cases

- `star 0`
- `star 9999`
- `star abc`

Unstar Command

Correct Case

- `unstar 1`

Edge Cases

- `unstar 0`
- `unstar 9999`
- `unstar abc`

GetStar Command

Correct Cases

- `getstar` (when starred flashcards exist)

Edge Cases

- `getstar` (no starred flashcards)

Help Command

Correct Case

- `help`

Exit Command

Correct Case

- `exit`

General Edge Cases

- Typing an unknown command (e.g., `randomCommand`)
- Missing prefixes (e.g., `add What is 2+2? 4`)
- Commands with extra spaces (should still work properly)