**✅ 1. User Authentication:**

* Users should be able to **register** and **log in** using a unique username and password.
* All user profiles must be stored and persisted using **file-based serialization**.
* Each user profile should maintain:
  + Unique user ID
  + Username and password
  + Conversion session data
  + Full conversion history

**✅ 2. Base-to-Base Number Conversion:**

* Allow users to convert numbers between **any two bases from 2 to 36**.
* Support:
  + Positive and negative integers
  + Floating-point numbers with **custom precision**
* If invalid input is provided (e.g., wrong digit for the base), show a **descriptive error message**.

**✅ 3. Conversion Session Management:**

* Track all conversions performed during a user’s current session.
* Each conversion must store:
  + Input value
  + Source base
  + Target base
  + Result or error message
* On logout, the current session’s conversions should be **added to the user's history**, grouped by the current date.

**✅ 4. Conversion History:**

* Store all past conversion sessions using a Map<LocalDate, List<Conversion>>.
* Provide options to:
  + View all past conversions grouped by date
  + Clear all history (with confirmation)

**✅ 5. Conversion Statistics:**

* Display the following statistics:
  + **Total conversions**:
    - In the current session
    - In full history
  + **Most used source and target bases**:
    - In the current session
    - In history

**✅ 6. Batch File Processing:**

* Let the user provide the **file path** of a batch input file.
* Each line of the file should be in the format:

nginx

CopyEdit

value sourceBase targetBase

* The system should perform all conversions, show results, and add them to the current session.

**✅ 7. Export Feature:**

* Allow the user to **export**:
  + Current session conversions
  + Full conversion history
* Support exporting to a .txt or .csv file

**✅ 8. Undo Last Conversion:**

* Allow the user to **undo** the most recent conversion done in the current session.
* Maintain a count of how many undos were performed during a session.

**✅ 9. Quiz Mode:**

* Randomly generate conversion problems for the user (e.g., convert 1011 from base 2 to base 10).
* Ask the user to input the answer.
* Show:
  + Whether the answer was correct
  + Correct answer (if wrong)
  + Explanation
  + Keep a running score for the session

**✅ 10. Search History:**

* Let users **search through their history** by:
  + Specific input value
  + Source or target base
  + Date or date range

**✅ 11. Session Summary on Logout:**

When the user logs out, display a **session summary** including:

* Total conversions performed
* Number of successful vs failed conversions
* Most used base pair
* Undo count

**✅ 12. Multi-User Mode with Admin View:**

* Add support for **admin users**.
* Admins should be able to:
  + View all registered users
  + View total conversions by each user
  + Reset or clear any user's history (with confirmation)