CS 520: Homework 3 - Implementation & Debugging

1. **Objective:**

The feature focuses on enabling users to export their list of transactions to a CSV file. Care has been taken that the filename is valid and is formatted properly

2. **Functionality Description:**

- The user is asked to enter the filename that they want to export
- The entered filename is validated
- Once the validity of the filename is done, the transactions are exported to the file in CSV format
- The first row of the file has headers → Date, Amount, Category
- Every row after the header has a transaction, with each row properly formatted

3. **Architecture Description**

- The export feature in the application is designed using MVC (Model View Controller) design pattern.
- This separates the concern, which will be explained in the coming part
- As per our design,
  The **Model** manages the list of transactions.
  The **View** helps in the interaction with the user and takes the input and displays the messages that let the user know if the file has been exported successfully
  The **Controller** validates the filename and does the actual export process
- This architecture helps in maintaining modularity, thus making it easy to troubleshoot and easy to maintain

4. **Brief Description of Model, View, and Controller**

a. **Model:**

- The model maintains and manages the list of all transactions
- It provides access to the stored transactions
- These transactions can then be exported.

- The model also handles data-related logic such as adding, removing, and retrieving transaction records.
- The existing getTransactions method of the model can be used to get list of transactions in read-only format for the export operation.

```
/**
 * Returns unmodifiable list of all transactions.
 * @return List of transactions
 */
public List<Transaction> getTransactions() {
  return Collections.unmodifiableList(new ArrayList<>(transactions));
}
```

- The unmodifiable list that is returned helps in maintaining the integrity of the data

b. **View**:

- The View interacts with the users and prompts for input by asking for a filename
- It also displays messages that let the user know if the export process has been successful or not
- A method, as shown below, can be added to ask the user for a filename

```
Java
    public String provide_FileName() {
        return JOptionPane.showInputDialog(null, "Hello, User! Please enter
your filename");
    }
```

- Similarly, another method can be used to display the messages that confirm to the user if the file has been successfully exported or if the export has failed.

```
Java
    public void show_message(String message) {
        System.out.println(message); // Outputs messages to user
    }
```

c. Controller:

- The Controller is responsible for handling data for exporting transactions
- It is also responsible for validating the filename provided by the user
- Additionally, it coordinates with the view to display messages and with the model to retrieve transactions
- It initiates the process to write transactions to the file as requested by the user
- To facilitate this process, the following methods are
  used export_file_to_CSV() for actual import logic
  make_header_valid() is used to remove comma so that each column name looks properly formatted.
  It checks if the filename has csv. It also checks for special characters as well as for the empty or null
  check_if_file_valid() to check the filename provided by the user is correct or not

Java

```java
private static final String FILE_HEADERS = "Date,Amount,Category";
private static final String FILE_NAME_INVALID = "Dear User, Entered file name
is invalid. It must end with .csv and not contain special characters.";
private static final String SUCCESSFUL_EXPORT = "Dear User, Transactions are
successfully exported to the given file";
private static final String ERROR_IN_EXPORT = "Dear User, Something went wrong
while exporting: ";

public void export_file_to_CSV(String name_file) {
    if (!check_if_file_valid(name_file)) {
        view.displayMessage(FILE_NAME_INVALID);
        return;
    }

    try (FileWriter f_writer = new FileWriter(name_file)) {
        f_writer.write(FILE_HEADERS + "\n");
        for (Transaction w_tran : model.getTransactions()) {
            writer.write(String.format("\"%s\",\"%s\",\"%s\",%.2f\n",
                    make_header_valid(w_tran.getDate()),
                    make_header_valid(w_tran.getTimestamp()),
                    w_tran.getAmount()));
        }
        view.displayMessage(SUCCESSFUL_EXPORT + ": " + name_file);
    } catch (IOException e) {
        view.displayMessage(ERROR_IN_EXPORT + e.getMessage());
    }
```

```
}
```

```java
 private String make_header_valid(String value) {
        return value.replace("\"", "\"\"");
    }
```

```java
    private boolean check_if_file_valid(String name_file) {
        if (name_file == null || name_file.trim().isEmpty()) return false;
        if (!name_file.toLowerCase().endsWith(".csv")) return false;
        if (name_file.matches(".*[\\\\/:*?\"<>|].*")) return false;

        String f_name = name_file.replaceAll("(?i)\\.csv$", "").toUpperCase();
        boolean valid_Name =
!f_name.matches("CON|PRN|AUX|NUL|COM[1-9]|LPT[1-9]");
        return valid_Name;
    }
```

5. UI Design Laws

1. **Interactive**:
    - User centric interaction is an important aspect of user interface design

- When the error occurs, the user must not be left wondering what might have gone wrong
- The user must be provided with the information regarding the success and failure of the task that they are trying to complete
- Our system lets the user know when the entered filename is incorrect

2. **Provides help**:
    - When the user inputs filename that doesn't abide by the validations for it, our design provides error message which is concise and clear
    - This way the user can make the necessary changes and achieve the task successfully.
    - Such hints help in reducing the confusion and saves the user the frustration.

Example:

When the provided filename is in incorrect format, the user sees error message like -

"Entered file name is invalid. It must end with .csv and not contain special characters."

6. <u>OO Design principles:</u>

1. Single Responsibility principle:

- As per this principle a class should have one and only one reason to change
- In our design, we have separated the responsibilities so that Controller is only responsible for functionalities like

- `export_file_to_CSV` is responsible only for the export logic.

- `check_if_file_valid` is solely responsible for validating file names.

- `make_header_valid` is responsible for escaping/cleaning individual fields
- Model class is responsible for managing data (transactions)
- View class handles messaging

Thus, it can be seen that each of the classes has a focussed responsibility, thus obeys this principle

2. Open/Closed Principle:

- This principle states that system should be open for extension but closed for modification

- In our design, we can extend the logic for validating the filename like adding checks to set a limit to the size of the filename
- Similarly, currently, we only want the filename to be csv. However, this can be extended to include other formats as well like JSON, XML
- Hence, our system can be extended without changing the core

3. Dependency Inversion Principle

- This principle states that our system should depend on abstractions and not on concretions
- It is suggested in our design where Model and View are injected into the controller i.e. the controller doesn't instantiate them directly.
- Thus, this principle is implemented because we have avoided tightly coupling between controller and implementation details

7. Best Practices:

1. Using Method and Variable names that are self-explanatory:

- The method and variable name clearly explain what they do without any confusion
- This makes our code self explanatory

2. Encapsulation and Information Hiding:

- We are using unmodifiable list of transactions that we access from model using method getTransactions()
- Thus, this avoids accidental modification
- Hence, our Internal data is protected and only exposed through controlled access

3. Avoiding Magic Strings:

- We have used constants for headers in the csv file
- The error messages are also substituted with a constant
- This makes the code easy to modify where just change a single constant would help in modifying all the places where it is used
- This improves the readability and maintainability of the code

```Java
private static final String FILE_HEADERS = "Date,Amount,Category";
```

```
private static final String FILE_NAME_INVALID = "Dear User, Entered file name
is invalid. It must end with .csv and not contain special characters.";
private static final String SUCCESSFUL_EXPORT = "Dear User, Transactions are
successfully exported to the given file";
private static final String ERROR_IN_EXPORT = "Dear User, Something went wrong
while exporting: ";
```

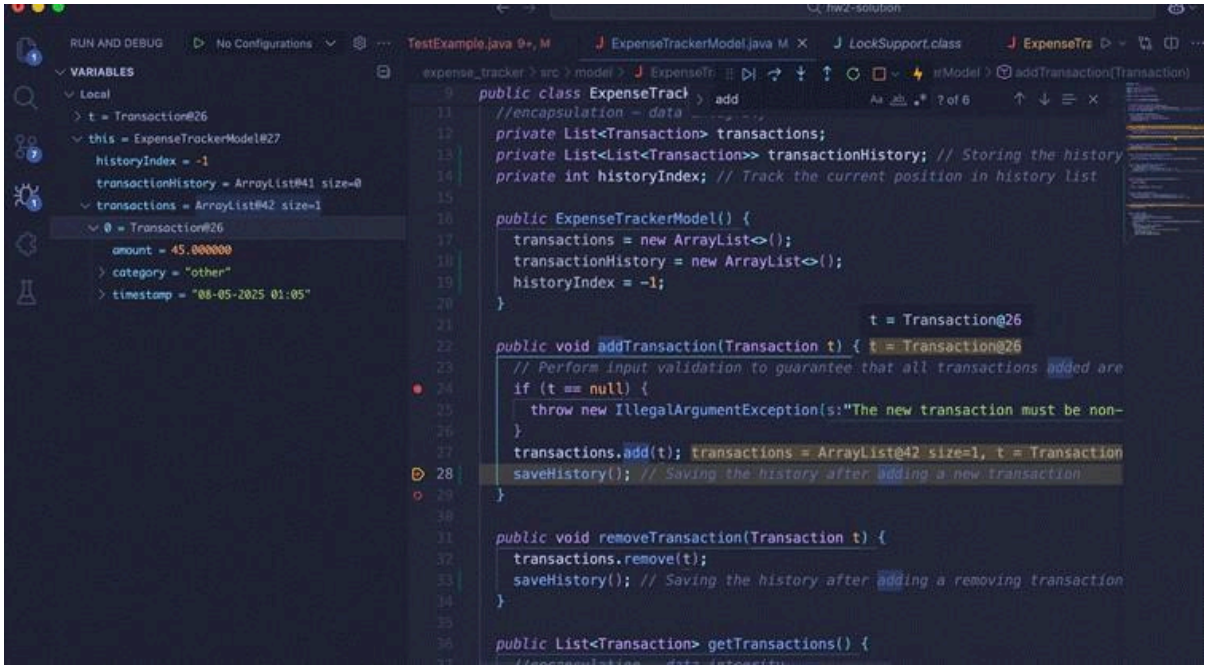
4. Error Handling:

- We don't want the app to shut down because of the error
- Hence, it is very important that the user is made aware of the potential error so that the user can mitigate it by making the necessary modifications.
- In our design, error is handled properly with the help of proper try and catch and also relevant error messages

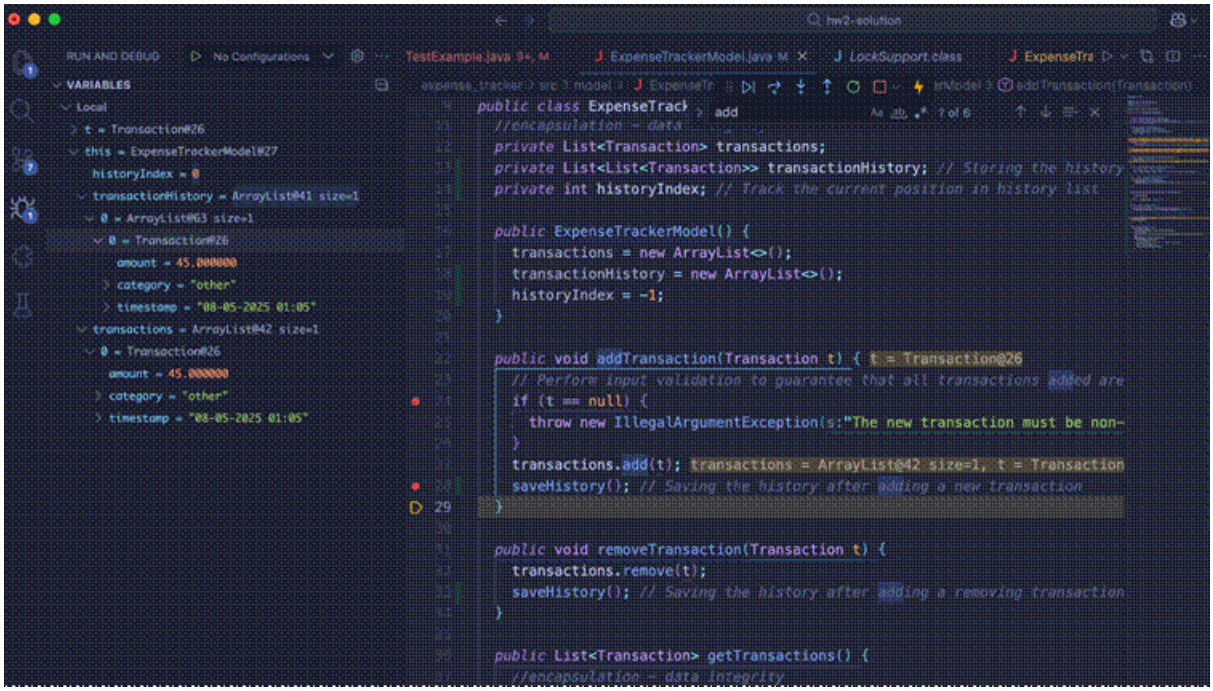
Debuggability.

Debuggability - IDE showing the breakpoint for the undo

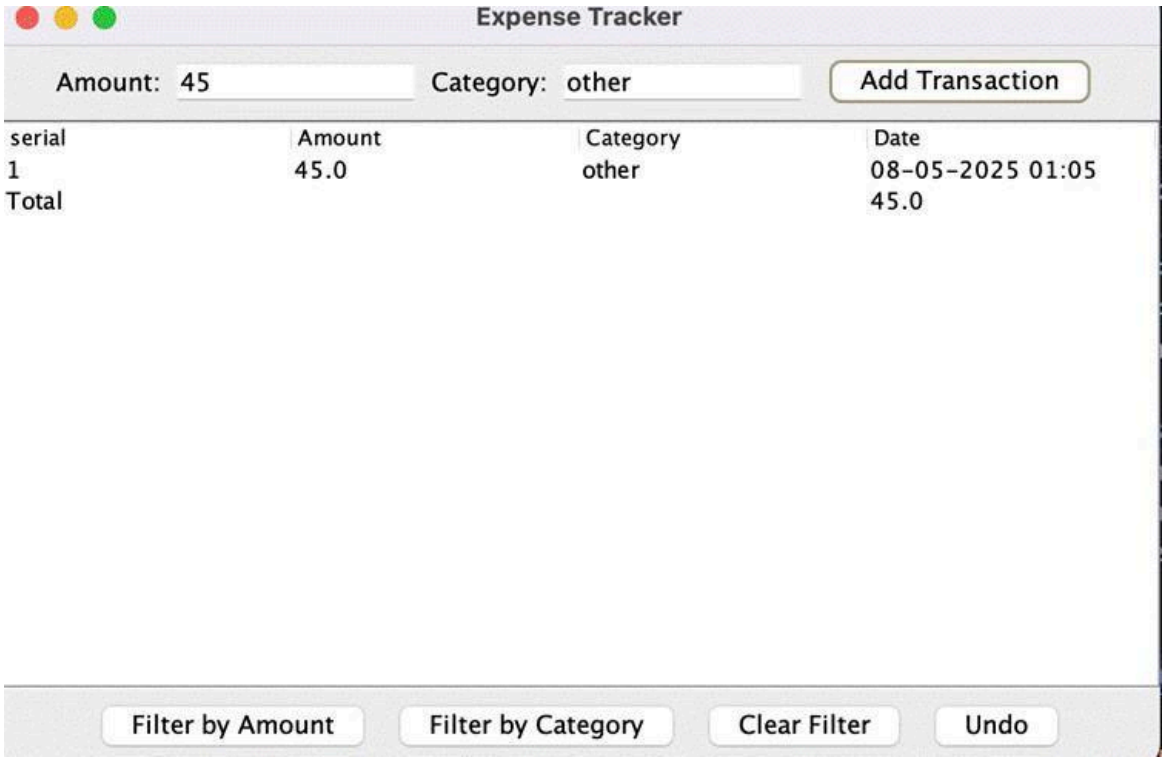
Debuggability - Debugger showing the program execution state(usually the variables view)after calling addtransaction but before calling undo (show the model and/or UI widgets set appropriately)



Added new transaction and the debugger entered the addTransaction block

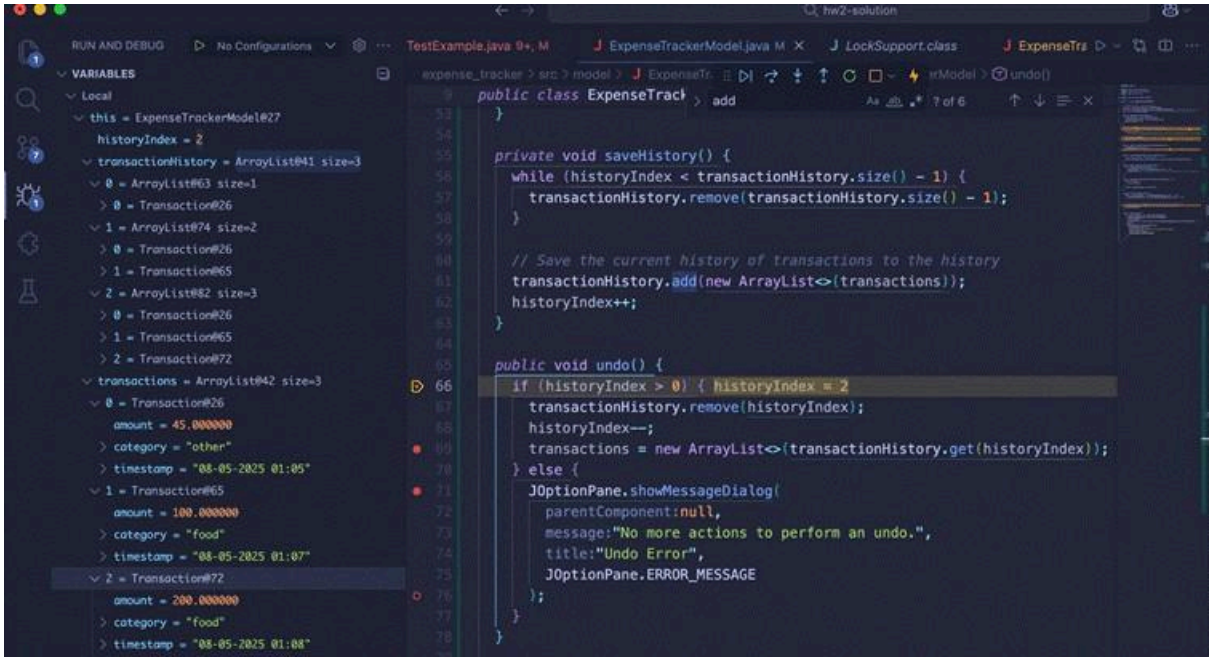


Transaction list got updated.

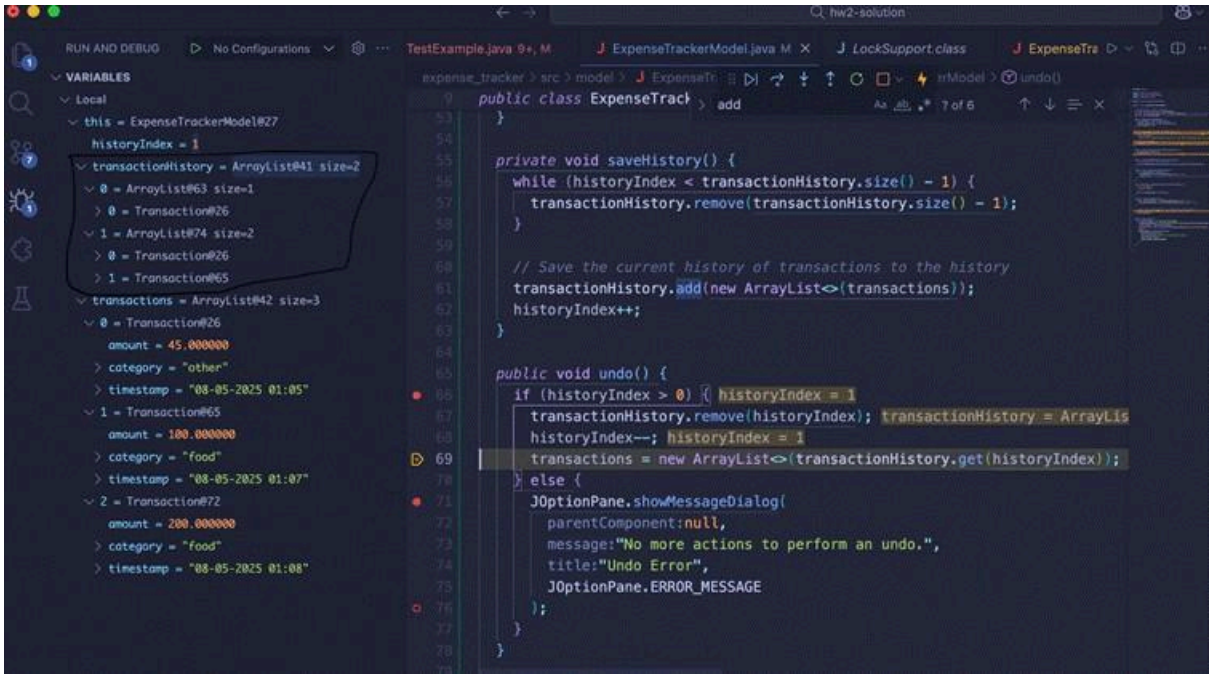


UI got updated after we are done with breakpoints

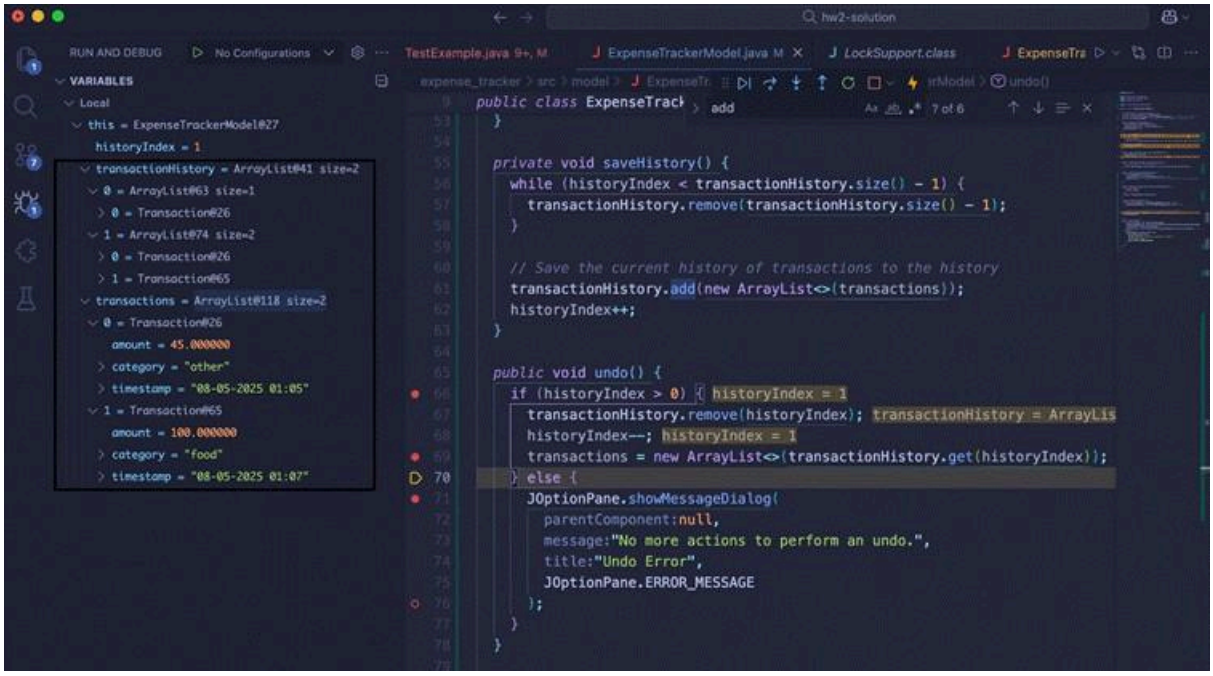
Debuggability - Debugger showing the program execution state (usually the variables view) after calling the undo (show the model and/or UI widgets are empty again)



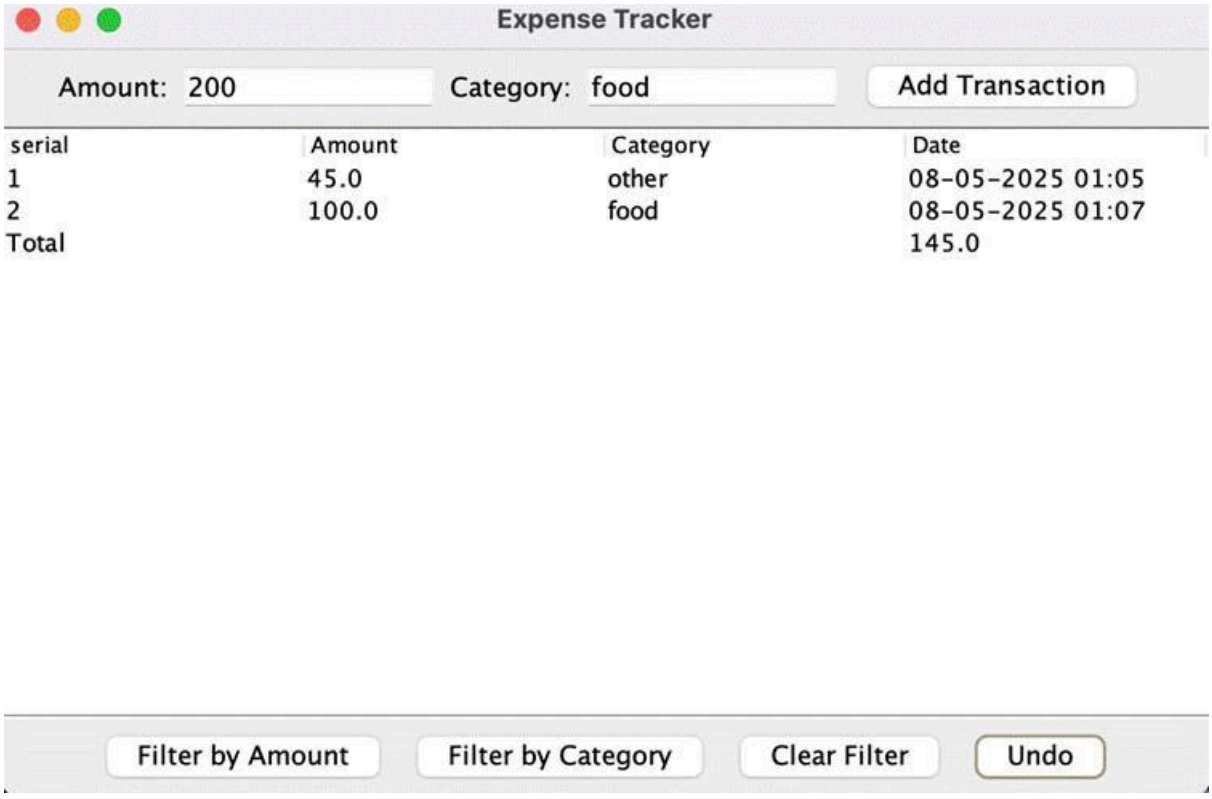
Initial state with 3 transactions before when debugger entered the Undo block.



The highlighted part shows that one translation got reduced from the history



The highlighted part shows that one transaction got reduced from the transaction list to0



Transaction got removed from the UI too.