N.P.E.

A Program Specification Document
for the course on
Introduction to Data Structures and Algorithms
(DASALGO)

Submitted by

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I. Introduction

The group has developed a program that simulates a mail delivery. At the start, the user will input their name and load a map file. After inputting the two, the user will then choose a post office to start with. The user will then input at least one mail for the current post office in order to be able to start the mail deliveries. As for a mail; the user will input the recipient, the recipient's address, the month, the day, the year, and the time (in hours and minutes). Once the delivery starts, the user will see an animation showing the delivery of the mails. The user will see the mails disappear from the list once they have been delivered. Furthermore, the order of the delivery after the first post office would depend on the recency of the mails. After each post office, the user can still input more mails. Once all the mails have been delivered, the user is then directed to the main menu. The user can then choose to start the process again or exit the program.

II. Data Structures

1. ArrayLists

Name	Purpose
maps	To store all the regions and their locations
bag	To store all the mails of the mailman
sorted	To store the sorted list of mails with destinations within the current region of the mailman
destinations	To store the list of JLabels in the animation panel and to access the labels outside the panel
connections	To store the list of locations connected to a location, as well as their distances from the location.
locations	To store all the different locations in a map
mails	To store all the mails of a Post Office

2. HashSet

Name	Purpose
set	To store the x-coordinate of each JLabel in the ArrayList destinations. The mail delivery truck stops at these x-coordinates. A HashSet was used to check if list contains the x-coordinate of the truck in constant time.

3. Weighted Graph

Name	Purpose
Map	a class to represent a region and its locations as an adjacency list. The class has a list of vertices (locations), and each location has a list of weighted edges (connections).

III. Algorithms

1. Searching algorithm

Name	Purpose
Linear	Linear search is used to find out if any of the specified lists contain a specific element. It is also used to traverse the list of connections (edges) to see which one has the shortest distance from a Post Office.
Dijkstra's algorithm	This algorithm is used to determine which location in the current city is to be visited first. Different cases would mean different routes. Using this algorithm, the shortest route is attained and used.

2. Sorting algorithm

Name	Purpose
Merge	The sort divides the mails list recursively into two until the sublists have only a mail. It then merges and arranges them until the list is sorted and whole again. The sort is used to arrange the mails according to their shortest distances from the current Post Office in ascending order.

IV. Program Flowchart

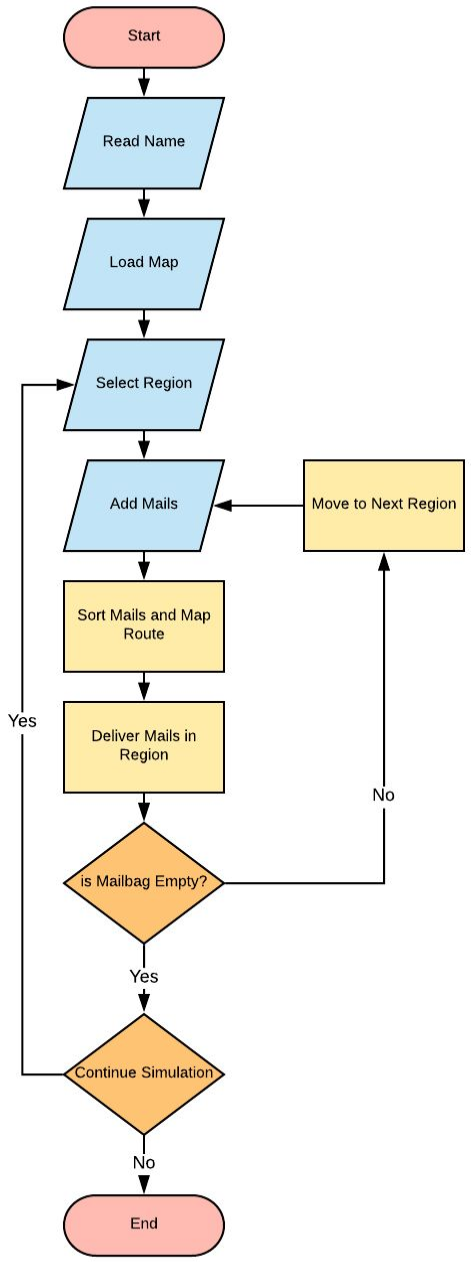

Figure 1. Flowchart

V. Program Features

1. Input User's Name

The user can input his or her name at the beginning of the game. The first name is the only one collected while the others are trimmed.

Figure 2. Name Input screen

2. Read Map File

The user can choose the Map file in CSV (Comma-Separated Values) format. The first line must be the category names, while the rest of the lines must be the data. The program is still able to read the file if it contains commas that are not separators, if there are extra separators, and if there are missing separators. However, the game will not proceed unless the user chooses a CSV file.

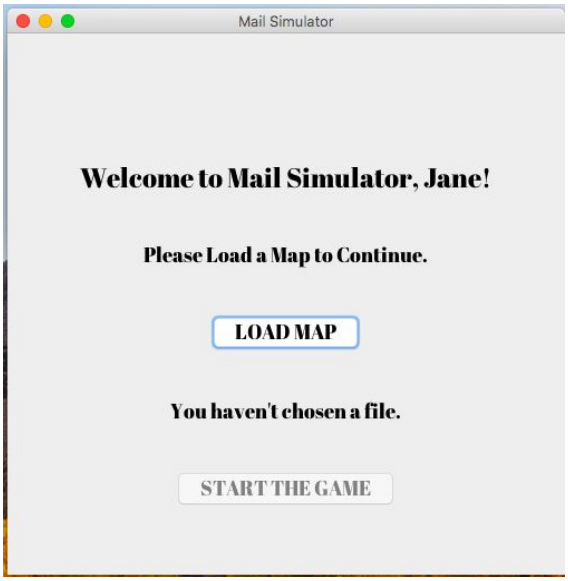

Figure 3. Load screen without a chosen CSV file

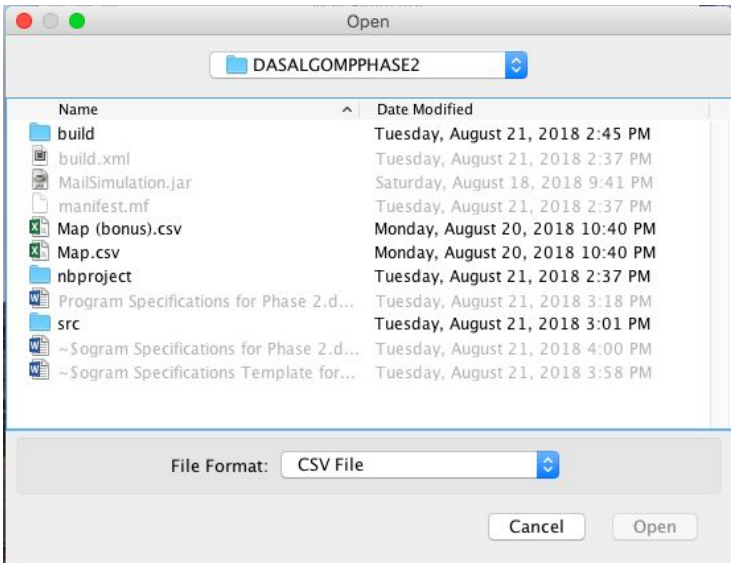

Figure 4. Screen when choosing a CSV file

Figure 5. Load screen when a file has been chosen

3. Select Post Office

The post offices will be derived from the chosen CSV file. The user can choose any of them as the current post office. The user cannot start the delivery without choosing one current post office.

Figure 6. Main menu without a chosen current post office

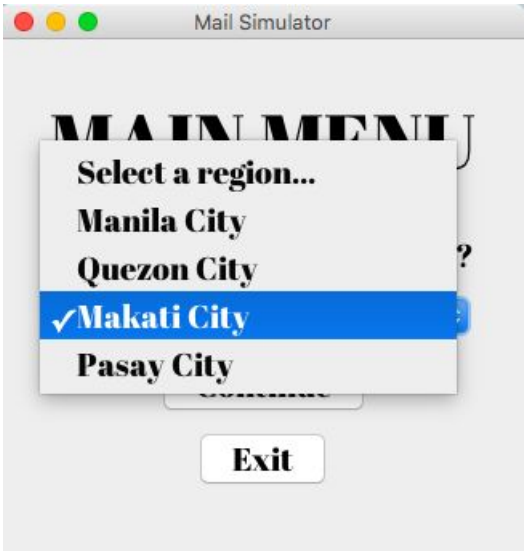

Figure 7. Screen when choosing a post office

Figure 8. Main menu screen with a chosen post office

4. Add Mail

The user can add mails after each office. The delivery cannot start if there are no added mails that are addressed to a location within the current region. The user will have to completely fill out the form for a mail in order for the mail to be allowed to be added to the list of mails.

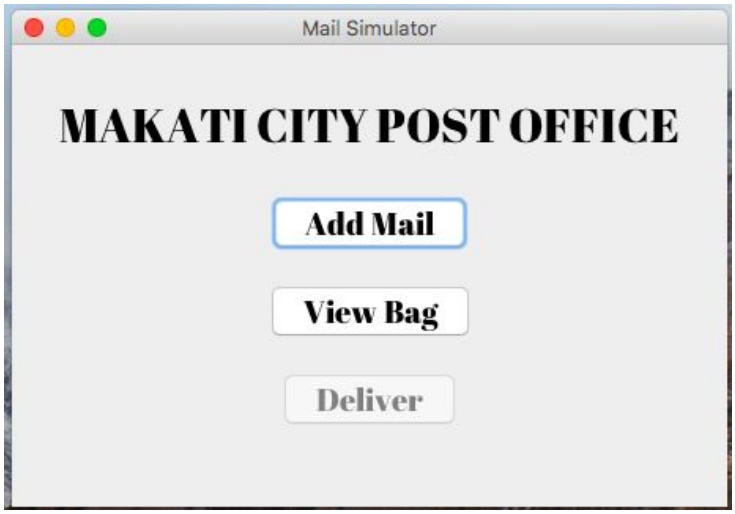

Figure 9. The post office menu when no mails are addressed to the current post office

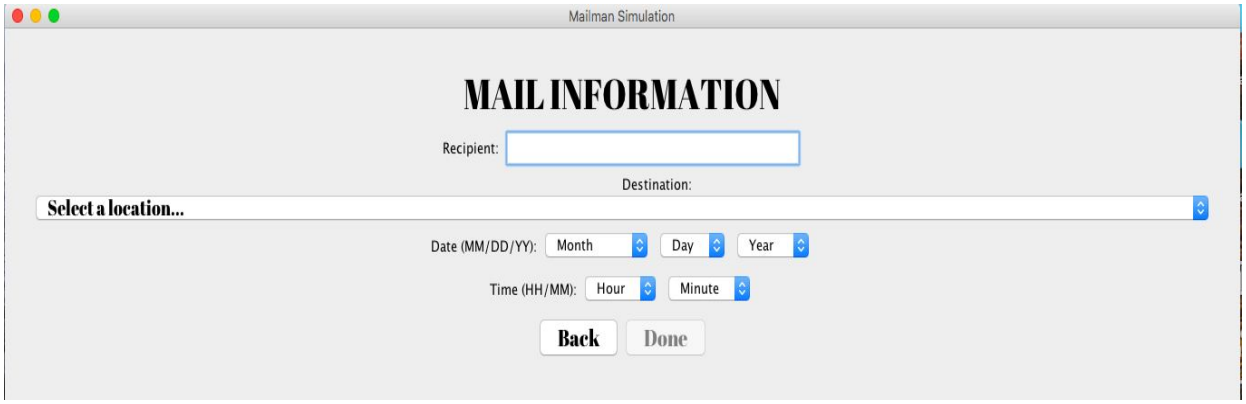

Figure 10. The Form screen to input mail data

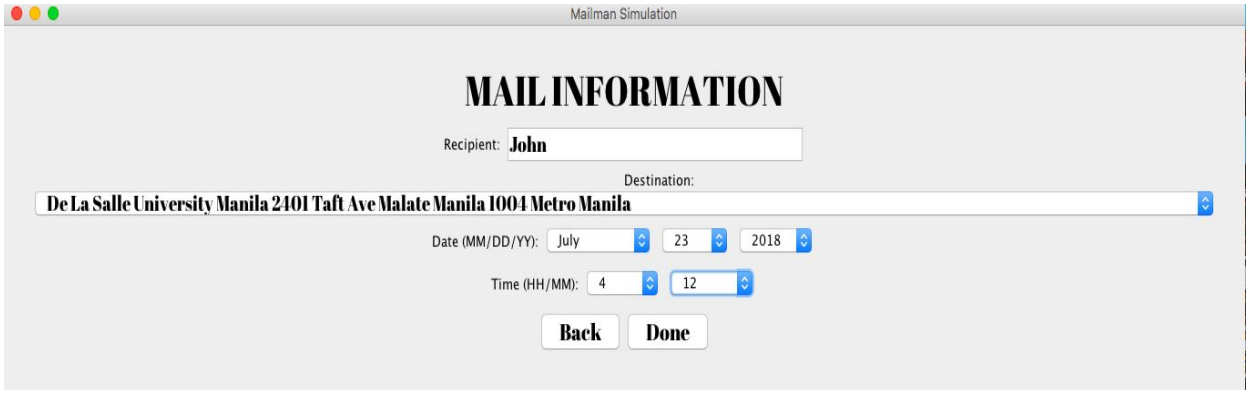

Figure 11. The form screen when all the required data are provided

5. View Bag

The user can view the list of mails. This feature displays the recipient, destination, date, and time of the mails. The recipient field has a maximum of 15 characters, and the destination field has a maximum of 50 characters.

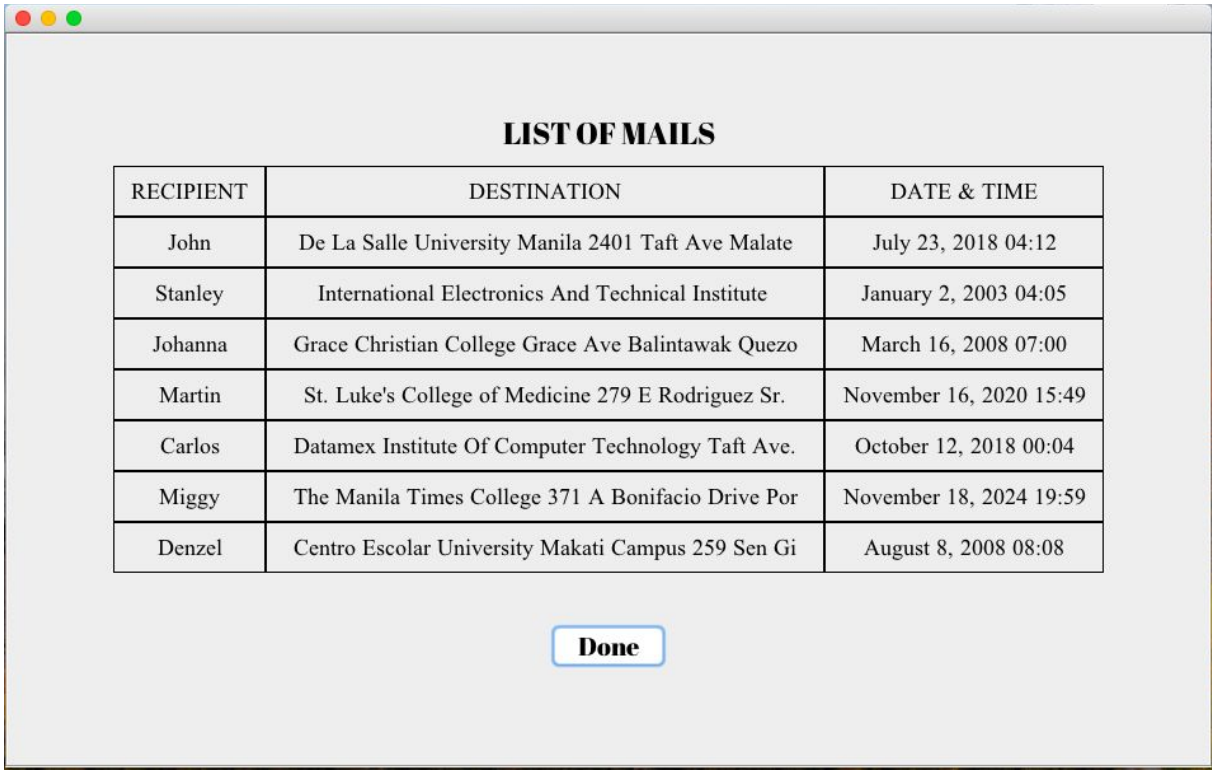

Figure 12. The View Bag screen

6. Deliver

The user can visually see the mails being delivered. Once a mail is delivered, it will be removed from the list of mails. (When the user views the bag again, the delivered mail will no longer be seen.)

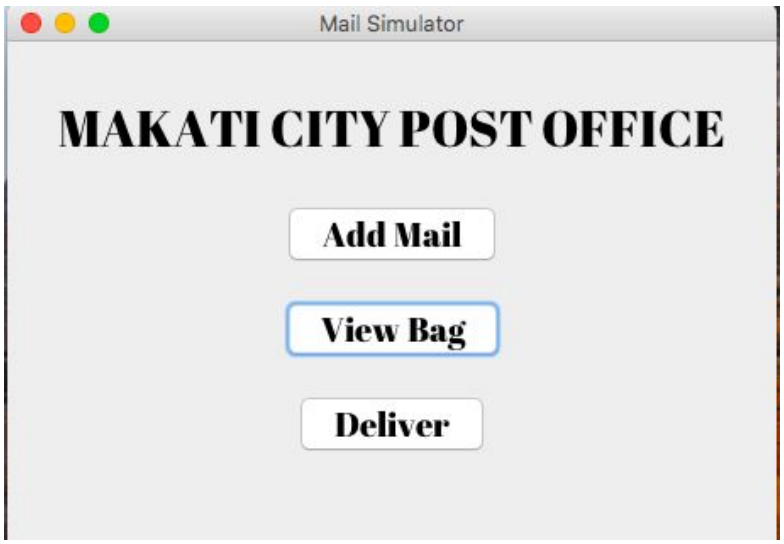

Figure 13. The post office menu when there is a mail addressed to the current post office

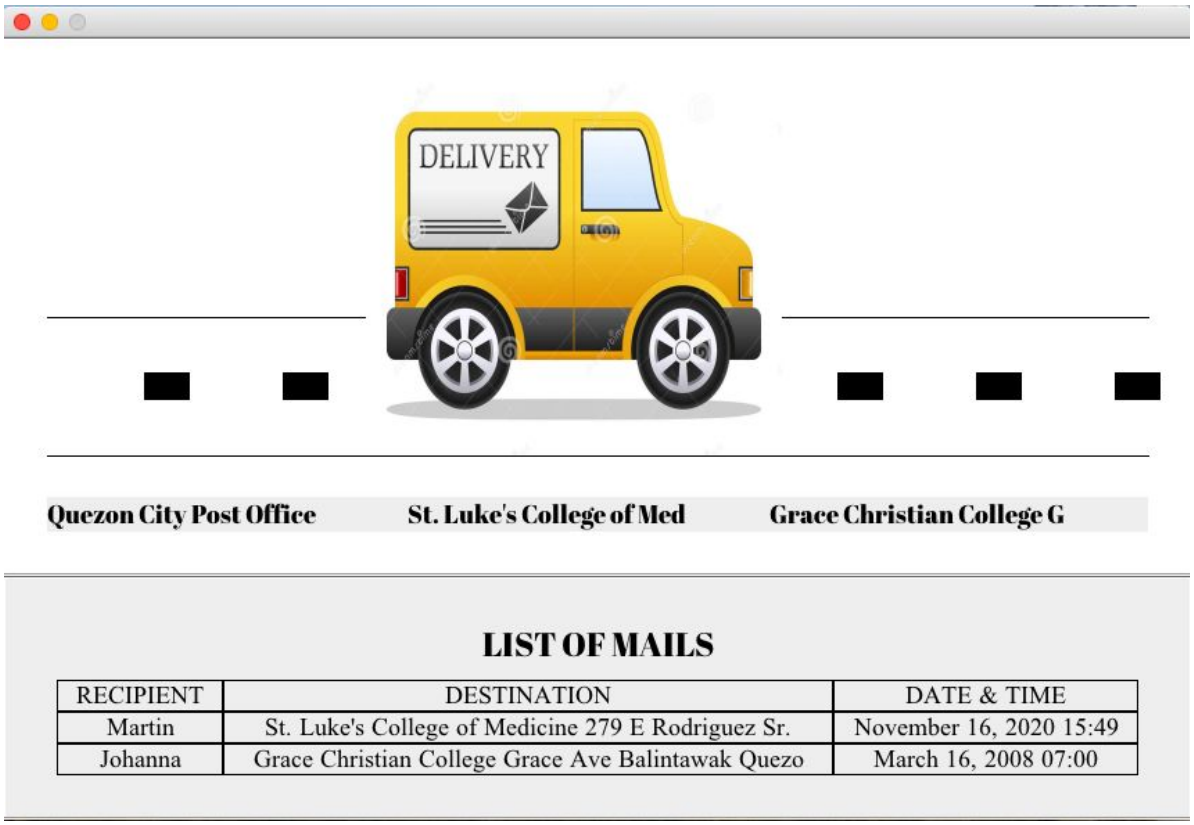

Figure 14. Delivery screen before delivering a mail

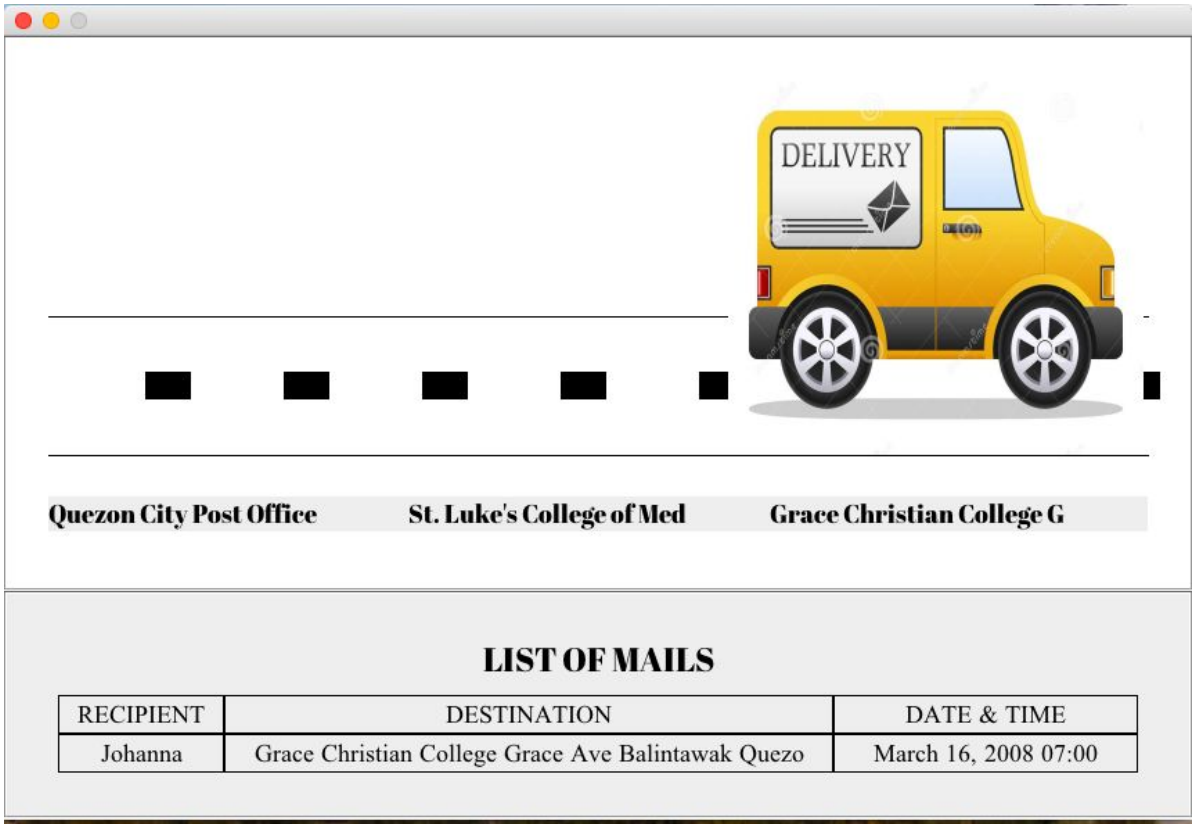

Figure 15. Delivery screen after delivering a mail

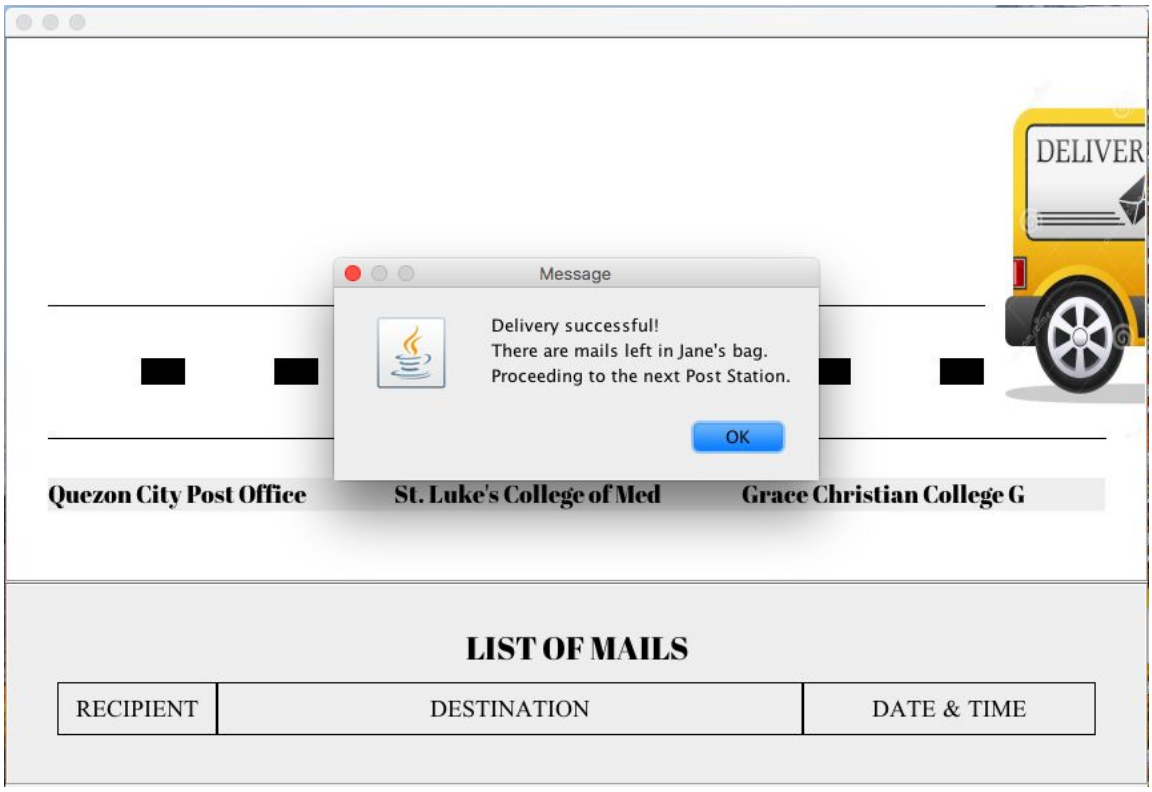

Figure 16. Delivery screen when all the mails of the current post office have been delivered

7. Exit

The user can repeat the delivery process as many times as he or she wants. Each process ends when the mail bag is empty. The user can exit the game by selecting the exit button in the main menu.

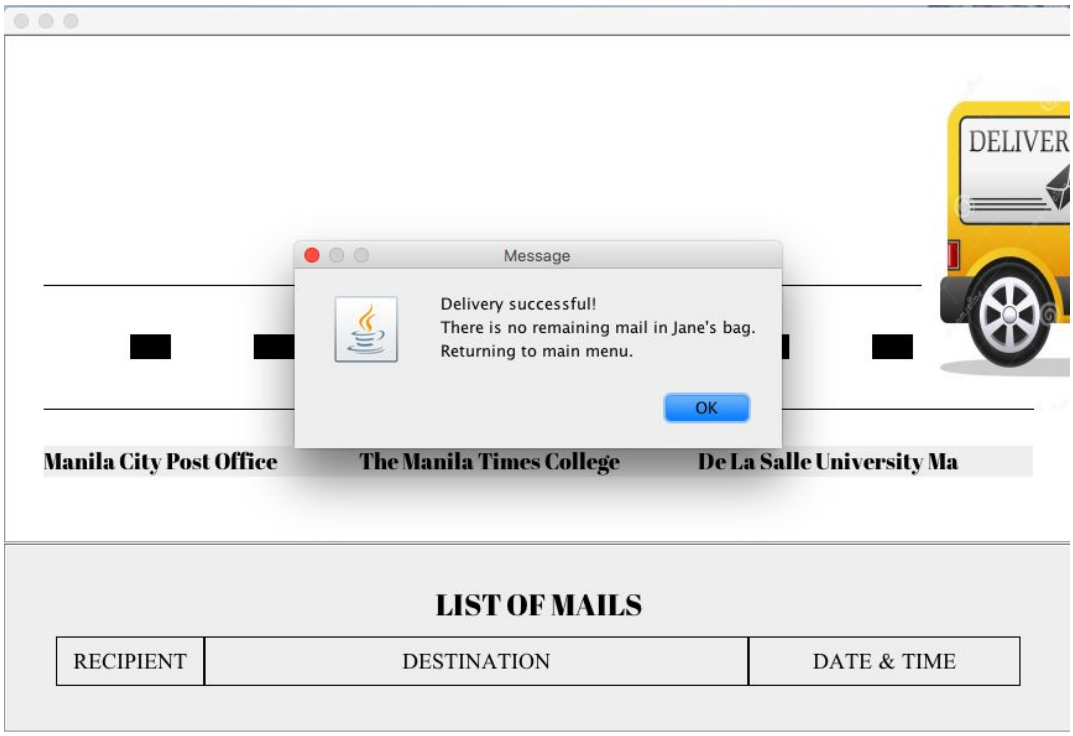

Figure 17. Delivery screen when all the mails have been delivered

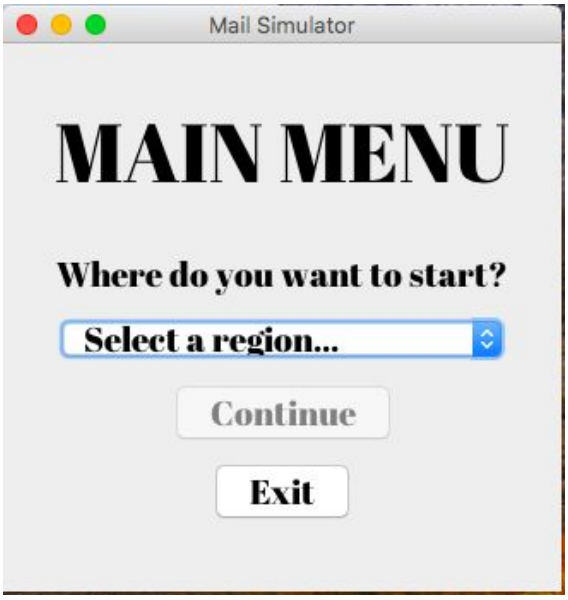

Figure 18. The screen after all the deliveries are finished

Figure 19. The exit confirmation screen

VI. References

Cartoon Delivery Van stock vector. (2018). Dreamstime.com. Retrieved from https://www.dreamstime.com/stock-image-cartoon-delivery-van-image25603811