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SECJ2013 – DATA STRUCTURES & ALGORITHMS

SECTION 02

GROUP PROJECT :

AIRLINE RESERVATION SYSTEM

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1. Objective

The objective of this project is to develop our own model of the Airline Reservation System. This system's aim is to ease the process for booking/reserving purposes for customers, while for administrator or staff is to validate the customers request, update or remove the customer from the booking list, search for customers and get information of customers when displaying the list with the user-friendly menu. The main idea and implementation of this project is to develop the system using the data structure concept of queue and must be correctly applied using C++ language. In this project we implemented the queue using a linked list.

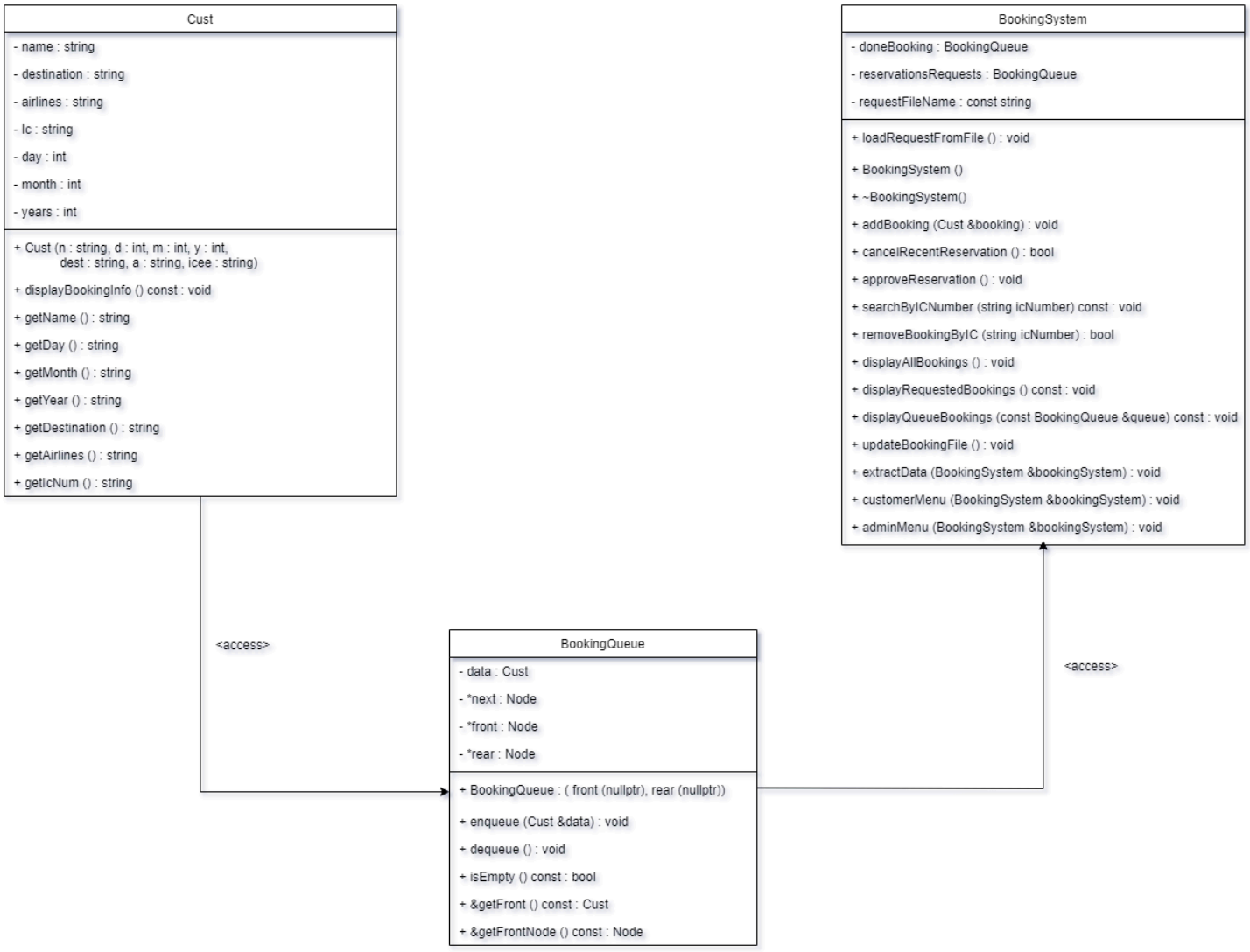
- Customers successfully request for the booking(enqueue)
- Customers can undo the request for reservation(dequeue)
- Admin can validate or approve the request reservation or booking from customer(dequeue from request list then enqueue to booking list)
- Admin can view details of customers list
- Admin can remove customer from booking list(dequeue)
- Admin can search for customer using IC number
- System provides user-friendly menu driven

2. Synopsis

the implementation of our airline reservation system, which has features for administrators and customers alike. Along with variables like name, destination, airline, booking date, and IC number, it has a Cust class that represents customers. The BookingQueue class, which uses linked nodes to construct a simple queue structure, is used by the programme to manage reservations. The system is managed by the BookingSystem class, which keeps track of two queues: reservationRequests for pending reservations and doneBooking for completed ones. The ability to approve reservations(queue and dequeue process), view all reservations, search for reservations by customer IC number, and remove(dequeue process) reservations are among the features that administrators can access.

Conversely, customers have the ability to make reservations(queue process), cancel their most previous reservation(dequeue process), and return to the main menu. Booking data is taken from a file (booking.txt) by the programme to initialise data. It communicates with users via console I/O, manages queues via linked lists, and handles errors resulting from incorrect selections. The admin, customer, and programme exit options on the system's main menu are customised to each user role's needs. The system offers an extensive feature set for efficient reservation management with the ultimate goal of simulating the workflow of an airline reservation system.

3. Class Design



PSEUDOCODE

Here's a pseudocode for the main part of our program in project:

```plaintext
class Customer
   attributes: name, destination, airline, day, month, year, IC

class BookingQueue
   class Node
      attributes: data (Customer), next (Node)

   attributes: front (Node), rear (Node)

   method enqueue(data)
      create Node with data
      if isEmpty()
         front = rear = newNode
      else
         rear.next = newNode
         rear = newNode

   method dequeue()
      if not isEmpty()
         temp = front
         front = front.next
         delete temp

   method isEmpty()
      return front == null

   method getFront()
      if not isEmpty()
         return front.data
      else
         throw out_of_range("Queue is empty")

class BookingSystem
   attributes: doneBooking (BookingQueue), reservationRequests (BookingQueue)

   method addBooking(booking)
      doneBooking.enqueue(booking)

   method reserveBooking(booking)
      reservationRequests.enqueue(booking)
```

```
    method cancelRecentReservation()
        if not reservationRequests.isEmpty()
            reservationRequests.dequeue()
            print "Most recent reservation canceled."
            return true
        else
            print "No reservation requests to cancel."
            return false

    method approveReservation()
        if not reservationRequests.isEmpty()
            process all reservations
            print "All reservations approved."
        else
            print "No reservation requests to approve."

    method searchByICNumber(icNumber)
        for each booking in doneBooking
            if booking.getIcNum() == icNumber
                display booking details
                return true
        print "No bookings found for IC Number " + icNumber
        return false

    method removeBookingByIC(icNumber)
        find and remove booking by IC number
        print "Booking for IC Number " + icNumber + " removed."

    method displayAllBookings()
        display all bookings

    method displayRequestedBookings()
        display reservation requests

function extractData(bookingSystem)
    open "booking.txt"
    if file not found
        print "Cannot open file."
        return
    else
        read lines from file
        extract and add data to bookingSystem

function customerMenu(bookingSystem)
    do
        display menu
        read user choice
```

```
    switch user choice
      case 1:
        input customer details
        create Customer
        bookingSystem.reserveBooking(newCustomer)
        print "Reservation request sent."
      case 2:
        input IC number
        bookingSystem.cancelRecentReservation()
      case 3:
        print "Returning to main menu."
  while user choice is not 3

function adminMenu(bookingSystem)
  do
    display menu
    read user choice
    switch user choice
      case 1:
        bookingSystem.approveReservation()
      case 2:
        bookingSystem.displayAllBookings()
      case 3:
        print "Returning to main menu."
      case 4:
        input IC number
        bookingSystem.searchByICNumber(IC number)
      case 5:
        input IC number
        bookingSystem.removeBookingByIC(IC number)
  while user choice is not 3

function main()
  create BookingSystem
  call extractData(bookingSystem)

  do
    display main menu
    read user type choice
    switch user type choice
      case 1:
        call adminMenu(bookingSystem)
      case 2:
        call customerMenu(bookingSystem)
  while user type choice is not 3

  pause and return 0
```

4. Problem Analysis

Airlines Reservation System needs to handle customer bookings and reservation efficiently to provide the best service thus need the reliable data transfer in and out. It needs to make sure that the data is accurate. Apart from that, the interface for users and the admin also need to be simple and nice as this can improve usability and ability to handle problems especially in handling the reservation and booking made. Below are the problem that lead to the making of this project:

- User interface
- Error handling
- Dynamic memory management for booking enqueue
- Data reliability and accuracy

5. Data Structure Implementation

● Class BookingQueue

The "BookingQueue" class represents a queue data structure. Specifically, it's an implementation of a queue using a linked list. The class includes the basic operations associated with a queue, such as enqueue (adding elements to the rear), dequeue (removing elements from the front), checking if the queue is empty, and retrieving the front element.

a) Enqueue Operation:

The enqueue method is used to add a new booking to the queue. It takes a Cust object as a parameter and creates a new node with this data. If the

queue is empty, both front and rear are set to the new node. Otherwise, the new node is added to the end of the queue, and the rear is updated.

```
void enqueue(Cust &data)
{
    Node *newNode = new Node{data, nullptr};
    if (isEmpty())
    {
        front = rear = newNode;
    }
    else
    {
        rear->next = newNode;
        rear = newNode;
    }
}
```

b) Dequeue Operation:

The dequeue method removes the front node from the queue. If the queue is not empty, it updates the front pointer to the next node, and the memory occupied by the front node is freed.

```
void dequeue()
{
    if (!isEmpty())
    {
        Node *temp = front;
        front = front->next;
        delete temp;
    }
}
```

c) getFront Operation:

This method returns a reference to the data (Cust object) stored in the front node of the queue.
The if (!isEmpty()) condition ensures that the queue is not empty before attempting to access the front node. If the queue is not empty, it returns a reference to the data of the front node (front->data). If the queue is empty, it throws an out_of_range exception with the message "Queue is empty."

```
Cust &getFront() const
{
    if (!isEmpty())
    {
        return front->data;
    }
    throw out_of_range("Queue is empty");
}
```

d) isEmpty Operation:

This method check if the queue is empty by verifying if the front pointer is equal to nullptr.

If front is nullptr, it means the queue is empty, and the method returns true. Otherwise, it returns false, indicating that the queue is not empty.

```
bool isEmpty() const
{
    return front == nullptr;
}
```

e) getFrontNode Operation:

The getFrontNode method is used to obtain a pointer to the front node. This is utilized in various parts of the program, such as when approving reservations.

```
Node *getFrontNode() const
{
    return front;
}
```

- ## Class BookingSystem

In the BookingSystem class, the queue is implemented using two instances of the BookingQueue class:

```
private:
    BookingQueue doneBooking;
    BookingQueue reservationRequests;
```

doneBooking and reservationRequests are private member variables of type BookingQueue. These variables represent two separate queues within the booking system.
doneBooking: This queue is used to store all the completed bookings (read from "booking.txt").
reservationRequests: This queue is used to store reservation requests made by customers.

a) **addBooking Method:**

The addBooking method, completed bookings (read from "booking.txt") are added to the doneBooking queue.

```
void addBooking(Cust &booking)
{
    // all done bookings from booki
    doneBooking.enqueue(booking);
}
```

b) **reserveBooking Method:**

The reserveBooking method, reservation requests made by customers are added to the reservationRequests queue.

```
void reserveBooking(Cust &booking)
{
    reservationRequests.enqueue(booking);
}
```

c) approveReservation

The approveReservation method, if there are reservation requests, they are dequeued from the reservationRequests queue and then enqueued into the doneBooking queue.

```
void approveReservation()
{
    if (!reservationRequests.isEmpty())
    {
        displayRequestedBookings();

        cout << "\n\t\t\t\tDo you want to approve all reservations? (1 for Yes, 0 for No): ";
        int decision;
        cin >> decision;

        if (decision == 1)
        {
            while (!reservationRequests.isEmpty())
            {
                Cust booking = reservationRequests.getFront();
                reservationRequests.dequeue();
                doneBooking.enqueue(booking);
            }
            cout << "\n\t\t\t\tAll reservations approved." << endl;
        }
        else
        {
            cout << "\n\t\t\t\tReservations not approved." << endl;
        }
    }
    else
    {
        cout << "\n\t\t\t\tNo reservation requests to approve." << endl;
    }
}
```

d) displayQueueBookings Operation:

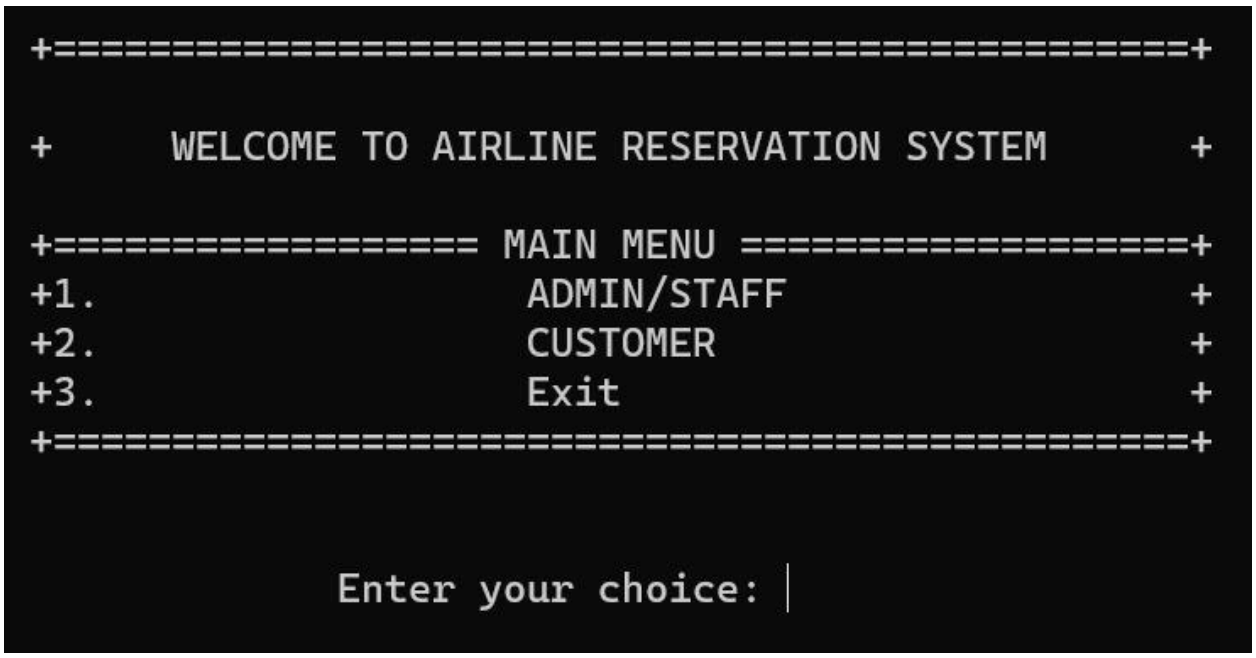
displayQueueBookings is responsible for traversing the nodes of a given BookingQueue and displaying the booking information stored in each node. It's a way to visualize the contents of the queue.

```
void displayQueueBookings(const BookingQueue &queue) const
{
    BookingQueue::Node *current = queue.getFrontNode(); // U

    while (current != nullptr)
    {
        current->data.displayBookingInfo(); // Display the bo
        current = current->next;            // Move to the ne
    }
}
```

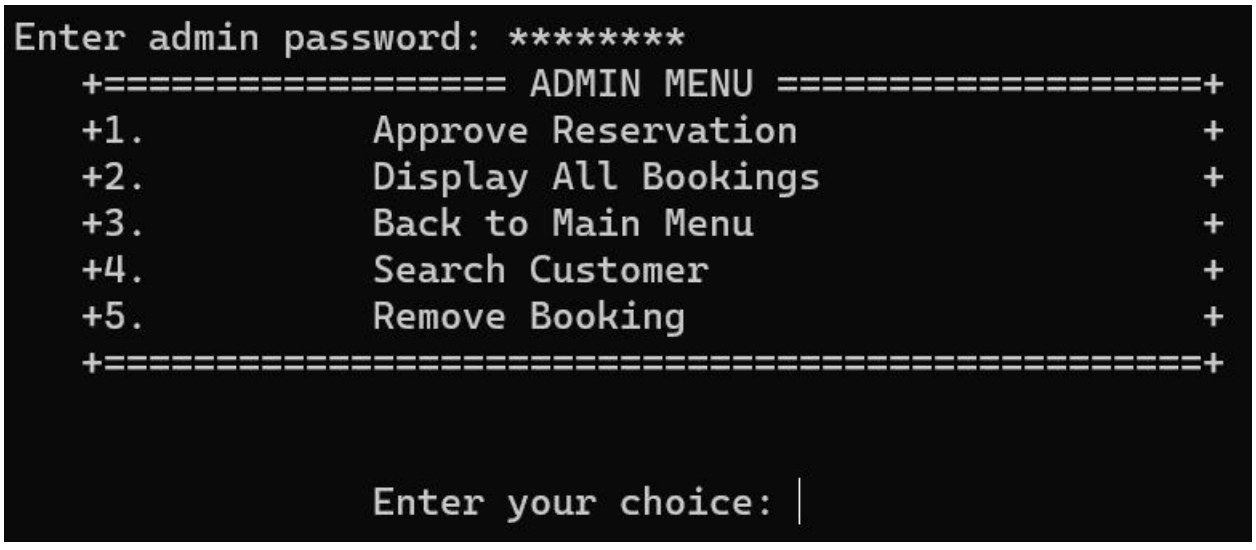
6. User Guide

I. Admin/Staff

A. The main page of the Airline Reservation System.



B. Please enter the admin password before login.



C. If user choose ‘1’, it will display the approvement of the customer booking

```
Enter your choice: 1
-------------------------------------------------------------------------------
Name          Date of Booking        Destination          Airlines        IC Number
-------------------------------------------------------------------------------
q              1  / 1  / 1             q                  q                 1
-------------------------------------------------------------------------------

                Enter the number of reservations to approve (0 to cancel): 0

                Reservations not approved.
```

D. If the user chooses ‘2’, it will display all the booking information.

```
                            Enter your choice: 2
-------------------------------------------------------------------------------
Name          Date of Booking        Destination          Airlines        IC Number
-------------------------------------------------------------------------------
Iman           26 / 12 / 2003          KB-KK              MasAirline         20103
Ariff          15 / 5  / 2008          KT-AS              AirAsia            30412
Marhumi        16 / 6  / 2009          PNG-KL             Malindo            93412
Ahmad Labu     2  / 23 / 2005          KUL-POL            MasAirline         030423030779
Danish         31 / 12 / 2030          KUL-JHB            MasAirline         030423030779
-------------------------------------------------------------------------------
```

E. If the user chooses ‘4’, it will show a prompt for user to begin searching for information based on customer IC and display the related information if found. Else, it will display ‘No bookings found for IC number: ’.

```
                            Enter your choice: 4

                Enter customer IC number to search: 30412

                Booking details for IC Number 30412:
-------------------------------------------------------------------------------
Name          Date of Booking        Destination          Airlines        IC Number
-------------------------------------------------------------------------------
Ariff          15 / 5  / 2008          KT-AS              AirAsia            30412
-------------------------------------------------------------------------------
```

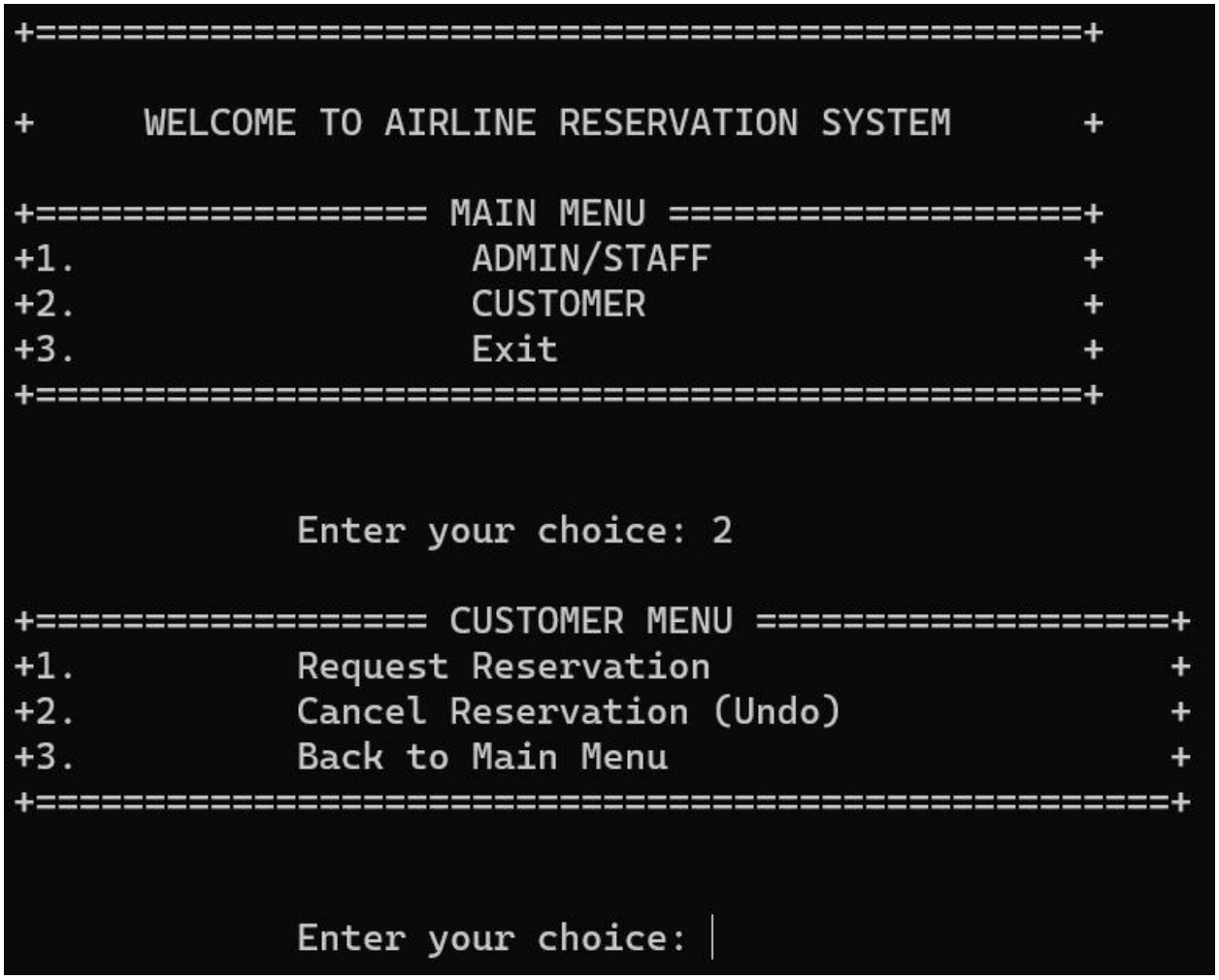
F. If the user chooses ‘5’, the system will ask the users to enter the IC number that will delete the booking. Then, its display the booking that was deleted is not in the list.

```
                    Enter your choice: 5
 Enter customer IC number to remove from booking: 30412

 Booking for IC Number 30412 removed successfully.

    +================== ADMIN MENU ==================+
    +1.          Approve Reservation                 +
    +2.          Display All Bookings                +
    +3.          Back to Main Menu                   +
    +4.          Search Customer                     +
    +5.          Remove Booking                      +
    +================================================+


                    Enter your choice: 2
-------------------------------------------------------------------------------
Name          Date of Booking        Destination          Airlines        IC Number
-------------------------------------------------------------------------------
Iman           26 / 12 / 2003           KB-KK             MasAirline         20103
Marhumi        16 / 6  / 2009           PNG-KL            Malindo            93412
Ahmad Labu     2  / 23 / 2005           KUL-POL           MasAirline         030423030779
Danish         31 / 12 / 2030           KUL-JHB           MasAirline         030423030779
-------------------------------------------------------------------------------
```

G. If user choose ‘3’, the system will exit and end.

II. Customer

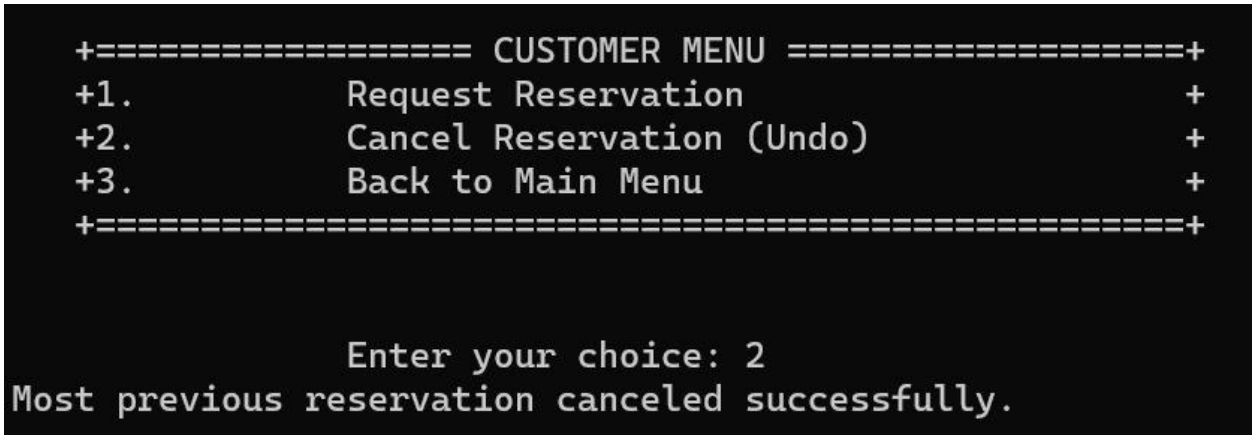
A. The main menu for customers.



B. If the user chooses ‘1’, the system will ask the user to insert a new customer name, date of booking, destination, type of airline and IC number. If the details are valid, it will notify the user ‘Reservation request sent successfully’.

```
                Enter your choice: 2

   +================== CUSTOMER MENU ==================+
   +1.          Request Reservation                    +
   +2.          Cancel Reservation (Undo)              +
   +3.          Back to Main Menu                      +
   +=================================================+


                Enter your choice: 1
Enter customer name: Harun Haziq Bin Rizki

Enter date (day month year):
Day : 20
Month :12
Year :2025

Enter destination: KUL-JHB

Enter airline: MasAirline

Enter IC number: 030423030779


Reservation request sent successfully.
```

C. If the user chooses ‘2’, the system will delete the previous booking and notify with ‘Most previous reservation canceled successfully’.



D. If the user choose ’3’, it will go back to the main menu.