DATA SRUCTURE AND ALGORITHM:

PROJECT OVERVIEW

(Sir Dr. Inayat ur Rehman)

Submitted by:

Faiq Shahzad *(FA19-BCS-021)*

Muhammad Ahmed *(FA19-BCS-041)*

TRAIN MANAGEMENT SYSTEM:

FEATURES:

The following project is a train management system that controls maximum aspects of a train management. This management system comprises of:

- Linked List
- Graphs
- Stack
- Array List
- Loops/Switch
- Console-based GUI
- Vectors
- File Handling

Credentials:

1. **Admin:**

   - Password

   TRAIN:

   - Insert a Train
   - View All Trains
   - Search Specific Train
   - Update Train Data
   - Delete a Train

   TICKETS:

   - View All Tickets
   - Search Specific Ticket
   - View Recent Tickets

   FILE HANDLING:

   - Back Up Data

2. **User:**

   - View All Trains
   - Book a Train
   - View **Minimum Distance** from one Station to another along with the **Trains on that Route**
   - View **Minimum Cost** from one Station to another along with the **Trains on that Route**

Working:

```
WELCOME TO TRAIN MANAGEMENT SYSTEM


        1---ADMIN
        2---USER
        0---EXIT

        Enter your choice:
```

ADMIN:

This management system allows the admin to perform various operations on the Trains and Tickets.

LOGIN:

The admin is required to provide password in order to access the Admin Menu.

Admin Password is **"admin123"**.

```
Enter Password: _
```

ADMIN MENU:

```
WELCOME TO TRAIN MANAGEMENT SYSTEM


        -----TRAIN--------
        Enter 1 to Insert
        Enter 2 to View All Trains
        Enter 3 to Search Specific Train
        Enter 4 to Update Train DATA
        Enter 5 to Delete Specific Train

        -----TICKET--------
        Enter 6 to View All Tickets
        Enter 7 to Search Specific Ticket
        Enter 8 to View Recent Tickets And Trains
        Enter 9 to BackUp data to File
        Enter 0 to LOGOUT

        Enter your choice: _
```

TRAIN INSERTION:

The admin can insert a train and all its details along with its routes and this process is performed using linked list and the data inserted is saved in the file **"trains.txt"**.

```
Enter Train Id:123DN

Enter Train Name:GreenLine

Enter Train source:rawalpindi

Enter Train destination:karachi

Enter Train arrivalTime:600

Enter Train departureTime:630

Enter Train Available Seats:197

Enter Cost of a seat:2500

Enter Distance between Cities(KM):1000

Inserted Train no:123DN


 DATA SAVED!

Press any key to continue . . . _
```

VIEW TRAINS:

The admin has the access to view all the available trains along with details.

```
                                Enter your choice: 2
Train Id        Train Name    Train Source  Train Destination    Arrival Time    Departure Time    Available Seats    Cost      Distance
--------        ----------    ------------  -----------------    ------------    --------------    ---------------    ------    --------

  123DN          GreenLine      rawalpindi         karachi            600             630               197          2500       1000

  123UP          Greenline        karachi       rawalpindi            600             700               198          2500       1000

  120DN           Teezgam      rawalpindi           lahore           1600            2100                97           400        400

  121DN           Teezgam         lahore          karachi           1600            2100               100           800        900

  121UP           Teezgam         karachi           lahore           1600            2100               100           800        900

  120DN           Teezgam          lahore       rawalpindi           1600            2100               100           400        400

  160DN      PakistanExpress   rawalpindi        faisalabad          1230            1300               400           600        300

  161DN      PakistanExpress   faisalabad          karachi           1230            1300               400           900        850

  161UP      PakistanExpress      karachi        faisalabad          1230            1300               400           900        850

  160UP      PakistanExpress   faisalabad        rawalpindi          1230            1300               400           600        300

  110UP      LeopardExpress    faisalabad           lahore           1230            1300               400           200        350

  110DN      LeopardExpress        lahore        faisalabad          1230            1300               400           200        350
```

SEARCH SPECIFIC TRAIN:

The admin can search a specific train along a specific route by entering the source and destination.

```
Enter Train source:rawalpindi

Enter Train destination:karachi

 Train Id        Train Name     Train Source  Train Destination   Arrival Time    Departure Time   Available Seats    Cost         Distance
 --------        ----------     ------------  -----------------   ------------    --------------   ---------------    ----         --------
   123DN          GreenLine       rawalpindi         karachi           600             630              197          2500         1000

Press any key to continue . . .
```

UPDATE TRAIN DATA:

The admin has the authority to search and update a trains details, the train node is searched by its train id.

```
                                                                  Enter your choice: 4


 Enter Train Id:123DN

Enter Train Name:GreenlineExpress

Enter Train source:rawalpindi

Enter Train destination:karachi

Enter Train arrivalTime:1200

Enter Train departureTime:1245

Enter Train Available Seats:200

Enter Cost of a seat:2600

Enter Distance between Cities(KM):1000

 DATA SAVED!

Press any key to continue . . .
```

TRAIN DELETION:

The admin has the authority to delete a train with all its details and the tickets details booked for it would be lost.

```
                                                                  Enter your choice: 5


 Enter Train no to delete: 110DN

110DN Deleted
Press any key to continue . . .
```

VIEW TICKETS:

The admin can view all the tickets details for all the trains available.

```
                                            Enter your choice: 6


Ticket No.: 1                  Train No.: 120DN          Train Name: Teezgam
---------------------------------------------------------------------------------------------
BookerName: Ahmed              No. Of Seats: 3          Booked Cost: 1200
Source: rawalpindi              Destination: lahore         Arrival Time: 1600        Departure Time: 2100


Ticket No.: 2                  Train No.: 123UP          Train Name: Greenline
---------------------------------------------------------------------------------------------
BookerName: Faiq               No. Of Seats: 2          Booked Cost: 5000
Source: karachi                Destination: rawalpindi       Arrival Time: 600        Departure Time: 700
```

SEARCH SPECIFIC TICKET:

The admin can search or verify a specific ticket. This ticket can be accessed by entering its ticket number.

```
                                            Enter your choice: 7

Enter Ticket No.: 2

Ticket No.: 2                  Train No.: 123UP          Train Name: Greenline
---------------------------------------------------------------------------------------------
BookerName: Faiq               No. Of Seats: 2          Booked Cost: 5000
Source: karachi                Destination: rawalpindi       Arrival Time: 600        Departure Time: 700
```

VIEW RECENT TRAINS AND TICKETS:

Whenever a train is inserted or a ticket is booked, then two stacks are maintained, the one stack contains the train ids and the other stack contains the ticket number. The admin can view the most recently inserted train and booked ticket.

```
                                            Enter your choice: 8


Recent Booking ID is: 3

Recent Inserted Train: 111DN

Press any key to continue . . .
```

USER:

This management system allows the user to view the details of all the trains and give user access to book a ticket from one station to another.

USER MENU:

```
WELCOME TO TRAIN MANAGEMENT SYSTEM


        Enter 1 to View Trains
        Enter 2 to Book Ticket
        Enter 3 to View Minimum Distance and Cost
        Enter 0 to MAINMENU

        Enter your choice: _
```

VIEW TRAIN DETAILS:

It displays the details of all the trains available.

Enter your choice: 1

Train Id	Train Name	Train Source	Train Destination	Arrival Time	Departure Time	Available Seats	Cost	Distance
123DN	GreenlineExpress	rawalpindi	karachi	1200	1245	200	2600	1000
123UP	Greenline	karachi	rawalpindi	600	700	198	2500	1000
120DN	Teezgam	rawalpindi	lahore	1600	2100	96	400	400
121DN	Teezgam	lahore	karachi	1600	2100	100	800	900
121UP	Teezgam	karachi	lahore	1600	2100	100	800	900
120DN	Teezgam	lahore	rawalpindi	1600	2100	100	400	400
160DN	PakistanExpress	rawalpindi	faisalabad	1230	1300	400	600	300
161DN	PakistanExpress	faisalabad	karachi	1230	1300	400	900	850
161UP	PakistanExpress	karachi	faisalabad	1230	1300	400	900	850
160UP	PakistanExpress	faisalabad	rawalpindi	1230	1300	400	600	300
110UP	LeopardExpress	faisalabad	lahore	1230	1300	400	200	350
110DN	LeopardExpress	lahore	faisalabad	1230	1300	400	200	350

BOOK A TICKET:

First the user has to input the source station, then provide the destination.

Now, if there are no trains on that particular route then, the program will display an option to search again or go back to User Menu.

Otherwise, if the trains are available on the particular route, then the program will display all the trains on that specific route and ask user to input train id to book.

If the id is not correct the program will again display option to continue….

If the Train id is correct, then the program will ask for the booking details and will then provide an option to confirm.

Once a ticket is booked, the data is then written to file **"tickets.txt"**.

```
Enter Train source:rawalpindi

Enter Train destination:lahore

  Train Id         Train Name      Train Source  Train Destination    Arrival Time    Departure Time    Available Seats     Cost              Distance
  ---------        -----------     -------------  ------------------   -------------   ---------------   ----------------    ------            ------
    120DN            Teezgam         rawalpindi             lahore            1600              2100                  97      400              400

Enter Train Id to Book:120DN


 Booking Teezgam From rawalpindi To lahore


Enter Booker Name:Khalid

Enter Number of Seats:1


CONFIRM TICKET!
              Train No.: 120DN               Train Name: Teezgam
--------------------------------------------------------------------------------------------------------------

BookerName: Khalid            No. Of Seats: 1          Booked Cost: 400
Source: rawalpindi               Destination: lahore            Arrival Time: 1600          Departure Time: 2100


For main menu enter any other key:
Do you confirm ticket! (y/n):_
```

VIEW ROUTES:

It also allows the user to view the specific routes. This process is performed by using **Graph** and our **own algorithm** by modifying the **Dijkstra** and **Prims algorithms** using **adjacency matrix**.

> ➢ *Minimum Distance:*

User can view the minimum distance from one station to another, also the user can view the route take and the available trains on that route.

```
Current Cities are: (0) rawalpindi, (1) karachi, (2) lahore, (3) faisalabad,
Enter Soruce station(Number): 1

View Minimum Distance(d) / Cost(c): d


                         ***************************************************************
                         The Minimum distance from karachi to different cities is:
                         ***************************************************************

                                     karachi -> rawalpindi ====> 1000 KM
                                     Minimum Route is: karachi -> rawalpindi

                                     AVAILABLE TRAINS ON ROUTE:
```

Train Id	Train Name	Train Source	Train Destination	Arrival Time	Departure Time	Available Seats	Cost	Distance
123UP	Greenline	karachi	rawalpindi	600	700	198	2500	1000

```
                                     karachi -> lahore ====> 900 KM
                                     Minimum Route is: karachi -> lahore

                                     AVAILABLE TRAINS ON ROUTE:
```

Train Id	Train Name	Train Source	Train Destination	Arrival Time	Departure Time	Available Seats	Cost	Distance
121UP	Teezgam	karachi	lahore	1600	2100	100	800	900

```
                                     karachi -> faisalabad ====> 850 KM
                                     Minimum Route is: karachi -> faisalabad

                                     AVAILABLE TRAINS ON ROUTE:
```

Train Id	Train Name	Train Source	Train Destination	Arrival Time	Departure Time	Available Seats	Cost	Distance
161UP	PakistanExpress	karachi	faisalabad	1230	1300	400	900	850

> ➤ *Minimum Cost:*

User can view the minimum cost from one station to another, also the user can view the route take and the available trains on that route.

```
Current Cities are: (0) rawalpindi, (1) karachi, (2) lahore, (3) faisalabad,
Enter Soruce station(Number): 0

View Minimum Distance(d) / Cost(c): c


                              **************************************************************
                              The Minimum Cost from rawalpindi to different cities is:
                              **************************************************************

                                        rawalpindi -> karachi ====> 1200 RS
                                        Cheapest Route is: rawalpindi -> lahore -> karachi

                                        AVAILABLE TRAINS ON ROUTE:

 Train Id        Train Name      Train Source   Train Destination      Arrival Time     Departure Time    Available Seats     Cost       Distance
 ---------       -----------     -------------  ------------------     -------------    ---------------    ----------------    ------     ---------
  120DN           Teezgam         rawalpindi          lahore              1600              2100                97             400          400

  121DN           Teezgam          lahore             karachi             1600              2100                100            800          900


                                        rawalpindi -> lahore ====> 400 RS
                                        Cheapest Route is: rawalpindi -> lahore

                                        AVAILABLE TRAINS ON ROUTE:

 Train Id        Train Name      Train Source   Train Destination      Arrival Time     Departure Time    Available Seats     Cost       Distance
 ---------       -----------     -------------  ------------------     -------------    ---------------    ----------------    ------     ---------
  120DN           Teezgam         rawalpindi          lahore              1600              2100                97             400          400


                                        rawalpindi -> faisalabad ====> 600 RS
                                        Cheapest Route is: rawalpindi -> faisalabad

                                        AVAILABLE TRAINS ON ROUTE:

 Train Id        Train Name      Train Source   Train Destination      Arrival Time     Departure Time    Available Seats     Cost       Distance
 ---------       -----------     -------------  ------------------     -------------    ---------------    ----------------    ------     ---------
  160DN        PakistanExpress    rawalpindi        faisalabad            1230              1300                400            600          300
```
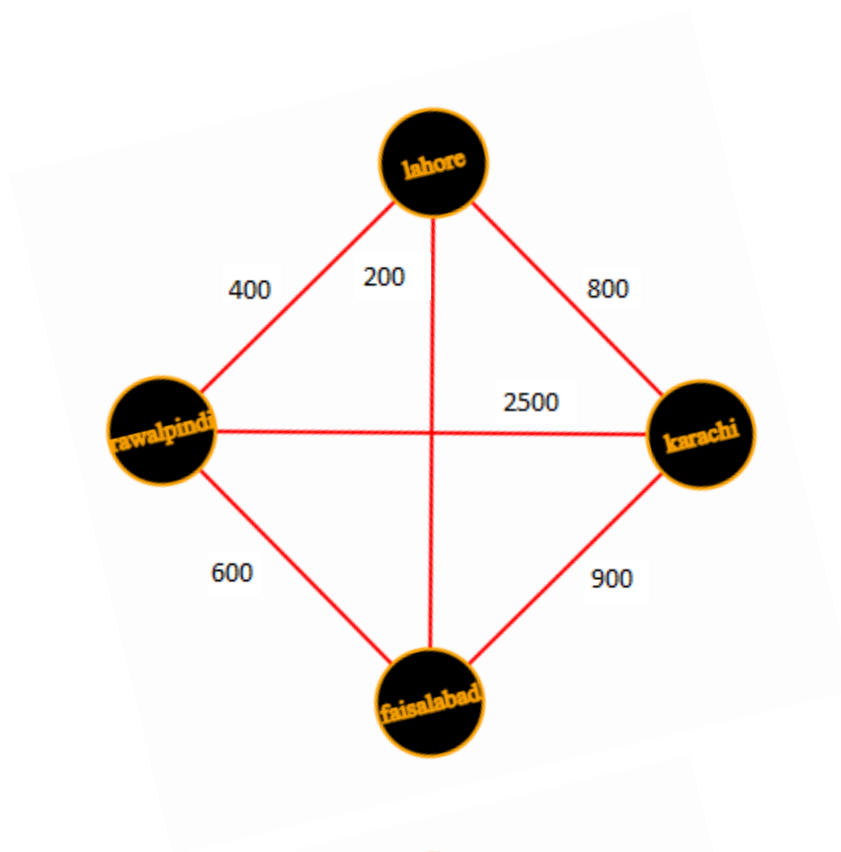
GRAPH:

So far, the following is the graph that is being constructed according to current stations and trains.

COST (RS):

DISTANCE (KM):