Discipline Core

Data Structures

CS4002

Assignment 3

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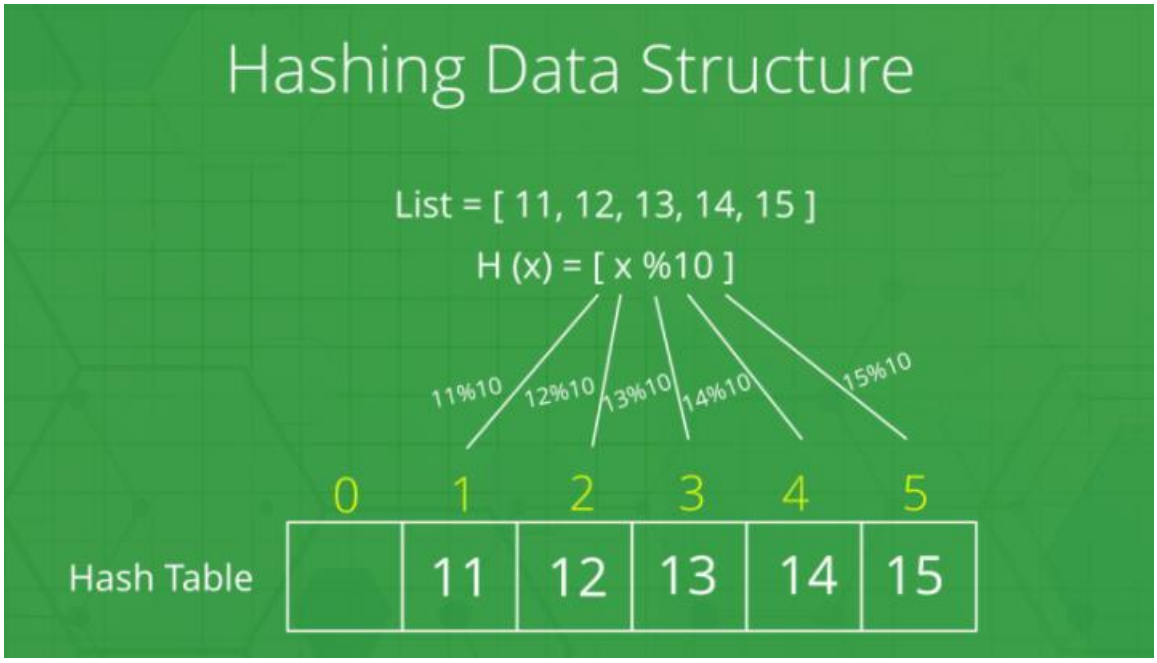
❖ Problem Statement: -

A railway reservation system books online seats for passengers based on some mathematical model. The passenger can book a ticket with his unique identification in the system. Based on the model the system generates the seat number and freezes the seat for the passenger. The train can have a maximum of 1 to N seats where N! = 0. If the number of passengers exceed the 'N' seats, then the system should handle such a scenario by maintaining a waiting list. Identify proper data structure to address the given scenario and write a C++ program for the system.

❖ Hashing: -

Hashing is an important Data Structure which is designed to use a special function called the Hash function which is used to map a given value with a particular key for faster access of elements. The efficiency of mapping depends of the efficiency of the hash function used.

Let a hash function H(x) maps the value at the index x%10 in an Array. For example, if the list of values is [11,12,13,14,15] it will be stored at positions {1,2,3,4,5} in the array or Hash table respectively.



❖ C++ CODE: -

```
1.  #include <iostream>
2.  using namespace std;
3.  #define size 7
4.
5.  // This is to mark an empty space in array.
6.  int initiator = -1;
7.
8.  // This is my struct array to store user data.
9.  struct page1{                          // So i cant make a class array as it
    is not working.
10.         string name;
11.         int age;
12.         long int adh_no;
13.         int reservation_quota;
14.         int train_nos;
15.         string journey_from;
16.         string journey_to;
17.         int tclass;
18.         string departure_date;
19. };
20.
21.
22. //Main class railway
23. class railway
24. {
25.         // Calling all the functions in public of this class.
26.         public:
27.                 void booking();
28.                 void user_data();
29.                 int  quota_option();
30.                 int  class_option();
31.                 void review_user_data(page1 block);
32.                 void create_hash_table();
33.                 void insert();
34.                 void status();
35.                 void search(int adh_no,string name);
36.                 void conformation_and_review();
37.
38.
39.                 // Making a constructor for automatic inialisation from main
    part.
40.                 railway(){
41.                         create_hash_table();
42.                 }
43.
```

```
            void rail(){

                int ch;

cout<<endl<<endl<<"\t\t\t\t\t\t~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~"<<endl;
                cout<<"\t\t\t\t\t\t.......WELCOME TO RAILWAY RESERVATION SYSTEM...."<<endl;
cout<<"\t\t\t\t\t\t~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~"<<endl<<endl<<endl;

               cout<<endl<<endl<<"\t\t^^^^^^^^^^^^^^^^^^^^^^MAIN MENU^^^^^^^^^^^^^^^^^^^^^"<<endl;
               cout<<"\t\t1. Check Status"<<endl<<"\t\t2. Online Seat booking"<<endl<<"\t\t3. Exit"<<endl<<endl;
               cout<<"\t\t# Enter your choice: ";
               cin>>ch;
               cout<<endl;
               // using switch for user controlled movement.
               switch(ch)

               {
               case 1:
                   status();  // This function tells us whether the seat has been booked or not.
                   break;
               case 2:
                   booking();  // This function is for seat booking
                   break;
               case 3:
                   exit(0);     // To exit the system.
               }

            }
};

void railway :: booking(){

       int ch;
       char op;
       cout<<endl<<endl<<endl<<endl;
       cout<<"\t\t\t\t\t\t***********************************************"<<endl;
    cout<<"\t\t\t\t\t\t    **WELCOME TO THE SEAT BOOKING MENU**"<<endl;

cout<<"\t\t\t\t\t\t***********************************************"<<endl<<endl;
```

```
81.
82.     cout<<endl<<endl<<"\t\t^^^^^^^^^^^^^^^^^^^^^^^^Check before
   proceeding^^^^^^^^^^^^^^^^^^^^"<<endl;
83.     cout<<"\t\t1. Continue"<<endl<<"\t\t2. Back"<<endl<<"\t\t3.
   Exit"<<endl<<endl;
84.     cout<<"\t\t# Enter your choice: ";
85.     cin>>ch;
86.                 cout<<endl;
87.                 // using switch for user controlled movement.
88.                 switch(ch)
89.
90.                 {
91.                 case 1:
92.                       cout<<endl<<endl<<"\t\t# How many seats you want to
   book: ";
93.                       cin>>ch;
94.                       for(int i = 1 ; i<=ch; i++ )
95.                      {
96.                       cout<<endl<<endl<<endl<<"\t\t# Enter the user "<<i<<"
   details";
97.                                     user_data();          // This function is to
   data from the user.
98.                       }
99.
100.                          cout<<endl<<endl<<endl<<endl<<"\t\t# Do you want
   to return to main menu(y/n):- ";
101.                                    cout<<endl<<"\t\t(Press y to continue)";
102.                                    cout<<endl<<"\t\t(Press n to exit)";
103.                                    cout<<endl<<"\t\t:- ";
104.                                    cin>>op;
105.                                    if (op == 'y' || op == 'Y'){
106.                                           rail();        // This function will
   take us back to main menu.
107.                                    }else{
108.                                           exit(0);         // To exit the
   system.
109.                                    }
110.                                    break;
111.                     case 2:
112.                         rail();            // This function will take us
   back to main menu.
113.                         break;
114.                     case 3:
115.                         exit(0);             // To exit the system.
116.                     }
117.
118.       }
119.
```

```
120.      // This function { quota_option() } gives options to the user to
    select from many alternatives.
121.      int railway :: quota_option(){
122.            int ch;
123.          cout<<"\t\t1. GENERAL"<<endl<<"\t\t2. Tatkal"<<endl<<"\t\t3.
    Premium Tatkal"<<endl<<endl;
124.          cout<<"\t\t Enter your choice: ";
125.          cin>>ch;
126.          return ch;
127.             }
128.
129.      // This function { class_option() } gives options to the user to
    select from many alternatives.
130.      int railway :: class_option(){
131.            int ch;
132.          cout<<"\t\t1. Sleeper"<<endl<<"\t\t2. 3rd AC"<<endl<<"\t\t3. 2nd
    AC"<<endl<<"\t\t4. 1st AC"<<endl<<endl;
133.          cout<<"\t\t Enter your choice: ";
134.          cin>>ch;
135.          return ch;
136.             }
137.
138.      // Creating a variable of type block.
139.      page1 block;
140.
141.      void railway :: user_data(){
142.            char ch;
143.            // Taking user input and entering the value in respected part
    of block variable.
144.          cout<<endl<<endl<<endl<<"\t\t~ Enter your name:- ";
145.             cin>>block.name;
146.
147.             cout<<endl<<endl<<"\t\t~ Enter your age:- ";
148.             cin>>block.age;
149.
150.             cout<<endl<<endl<<"\t\t~ Enter the last 3 digits of your adhar
    number:- ";
151.             cin>>block.adh_no;
152.
153.             cout<<endl<<endl<<"\t\t~ Choose Reservation quota: "<<endl;
154.             // This function { quota_option() } gives options to the user
    to select from many alternatives.
155.             block.reservation_quota = quota_option();
156.
157.             cout<<endl<<endl<<"\t\t~ Enter the train number:- ";
158.             cin>>block.train_nos;
159.
160.             cout<<endl<<endl<<"\t\t~ Enter Journey from:- ";
```

```
161.            cin>>block.journey_from;
162.
163.            cout<<endl<<endl<<"\t\t~ Enter Journey to:- ";
164.            cin>>block.journey_to;
165.
166.            cout<<endl<<endl<<"\t\t~ Choose Class: "<<endl;
167.            // This function { class_option() } gives options to the user
    to select from many alternatives.
168.            block.tclass = class_option();
169.
170.            cout<<endl<<endl<<"\t\t~ Enter departure date(DD/MM/YYYY):- ";
171.            cin>>block.departure_date;
172.
173.
174.            cout<<endl<<endl<<"\t\t~ DO YOU WANT TO REVIEW FORM (y/n)
    [Press n to directly submit]:- ";
175.            cin>>ch;
176.
177.            if (ch == 'y' || ch == 'Y'){
178.                  // This function is to review and confirm what the user
    has entered.
179.                review_user_data(block);
180.                cout<<endl<<endl<<"\t\t~ Enter Y to submit or Enter M to
    Modify the details :- ";
181.                cin>>ch;
182.                if (ch == 'Y' || ch == 'y'){
183.                   insert();
184.                   }else{
185.                         cout<<endl<<endl<<"\t\t\t\t***********Enter
    details again***********";
186.                         user_data();
187.                   }
188.
189.            }else{
190.             // This function is to insert all the portions of block
    variable in hash table.
191.                  insert();
192.            }
193.      }
194.
195.      // This function is to review and confirm what the user has entered.
196.      void railway :: review_user_data(page1 block)
197.      {
198.            // Just diplaying the values we obtained from the user in
    portions of block variable.
199.
200.            cout<<endl<<endl<<endl<<"\t\t\t\t^^^^^^^^^^^^^^^^^^^^^ Review
    ^^^^^^^^^^^^^^^^^^^^"<<endl;
```

```
201.                    cout<<endl<<"\t\t\t\tName:         "<<block.name;
202.                    cout<<endl<<"\t\t\t\tAge:          "<<block.age;
203.                    cout<<endl<<"\t\t\t\tAdhar nos:    "<<block.adh_no;
204.
205.                    if (block.reservation_quota == 1){
206.                           cout<<endl<<"\t\t\t\tQuota:        "<<"General";
207.                    }else if (block.reservation_quota == 2){
208.                           cout<<endl<<"\t\t\t\tQuota:        "<<"Tatkal";
209.                    }else{
210.                           cout<<endl<<"\t\t\t\tQuota:        "<<"Premium
    Tatkal";
211.                    }
212.
213.                    cout<<endl<<"\t\t\t\tTrain nos:    "<<block.train_nos;
214.                    cout<<endl<<"\t\t\t\tJOUR_From:    "<<block.journey_from;
215.                    cout<<endl<<"\t\t\t\tJOUR_to:      "<<block.journey_to;
216.
217.                    if (block.tclass  == 1){
218.                           cout<<endl<<"\t\t\t\tClass:        "<<"Sleeper";
219.                    }else if (block.tclass == 2){
220.                           cout<<endl<<"\t\t\t\tClass:        "<<"3rd AC";
221.                    }else if (block.tclass == 3){
222.                           cout<<endl<<"\t\t\t\tClass:        "<<"2nd AC";
223.                    }else{
224.                           cout<<endl<<"\t\t\t\tClass:        "<<"1st AC";
225.                    }
226.
227.                    cout<<endl<<"\t\t\t\tDep_Date:
    "<<block.departure_date;
228.
229.      }
230.
231.
232.      // Creating an array of type page1 and size defined in macros.
233.      page1 hash[size];
234.
235.      // This is to create an empty hash table.
236.      void railway :: create_hash_table(){
237.             for (int i = 0; i<size; i++){
238.                    hash[i].adh_no = initiator;     // Note initiator = -1
    which is used for showing empty space.
239.             }
240.      }
241.
242.      // This function is to insert all the portions of block variable in
    hash table.
243.      void railway :: insert()
244.      {
```

```
245.            char ch;
246.            int key = block.adh_no % size;
247.      //    Checking whether the location is empty or not.
248.            if (hash[key].adh_no == initiator){
249.
250.                  hash[key].name = block.name;
251.                  hash[key].age = block.age;
252.                  hash[key].adh_no = block.adh_no;
253.                  hash[key].reservation_quota = block.reservation_quota;
254.                  hash[key].train_nos = block.train_nos;
255.                  hash[key].journey_from = block.journey_from;
256.                  hash[key].journey_to = block.journey_to;
257.                  hash[key].tclass = block.tclass;
258.                  hash[key].departure_date = block.departure_date;
259.
260.                  cout<<endl<<endl<<"\t\t=> Thank you for seat booking
   with us. Your seat has been booked";
261.                  cout<<" and your seat number is: "<<key;
262.                  rail();
263.            }else{
264.                  cout<<endl<<endl<<"\t\tYou are in the waiting list.";
265.                  rail();
266.            }
267.      }
268.
269.      // This function tells us whether the seat has been booked or not.
270.      void railway :: status()
271.      {
272.            int adh_no,n,nos;
273.            string name;
274.            cout<<endl<<endl<<endl<<endl;
275.            cout<<"\t\t\t\t\t\t*****************************************
   ***"<<endl;
276.          cout<<"\t\t\t\t\t\t      ** CHECK YOUR STATUS HERE **"<<endl;
277.
   cout<<"\t\t\t\t\t\t*****************************************"<<endl;
278.
279.            cout<<endl<<endl<<"\t\tBy what means you want to check your
   status ";
280.          cout<<endl<<"\t\t1. Adhar number";
281.          cout<<endl<<"\t\t2. Name";
282.          cout<<endl<<"\t\tEnter your choice here: ";
283.          cin>>n;
284.
285.          if (n == 1){
286.            cout<<endl<<endl<<"\t\t# Enter last 3 digits of your registered
   adhar number to check the status:- ";
287.                cin>>adh_no;
```

```
288.                search(adh_no,"NULL");
289.            }else if (n == 2){
290.                cout<<endl<<endl<<"\t\t# Enter your registered name to
    check the status:- ";
291.                cin>>name;
292.                search(9999,name);
293.            }
294.      }
295.
296.      // This function is to search the adh_no based on key value.
297.      void railway :: search(int adh_no, string name){
298.            char ch;
299.            int adhh_no = adh_no;
300.            int key1  = adhh_no % size;
301.            int key2;
302.            for (int i = 0; i<size; i++){
303.                if (name == hash[i].name){
304.                      key2 = hash[i].adh_no % size;
305.                }
306.            }
307.
308.            if (adhh_no == hash[key1].adh_no){
309.                cout<<endl<<endl<<"\t\t=> Your seat has been booked
    successfully !. Your details are: "<<endl;
310.                cout<<endl<<endl<<"\t\tYOUR SEAT NUMBER IS "<<key1<<"
    AND OTHER DETAILS ARE: ";
311.                review_user_data(hash[key1]);
312.            }else if(name == hash[key2].name){
313.                cout<<endl<<endl<<"\t\t=> Your seat has been booked
    successfully !. Your details are: "<<endl;
314.                cout<<endl<<endl<<"\t\tYOUR SEAT NUMBER IS "<<key2<<"
    AND OTHER DETAILS ARE: ";
315.                review_user_data(hash[key2]);
316.            }else{
317.                cout<<endl<<endl;
318.                cout<<endl<<"\t\t Oops! It seems you are not
    registered";
319.                cout<<endl<<endl<<"\t\t Do you wanna register your
    self(y/n) [Enter n to return to main menu]: ";
320.                cin>>ch;
321.                if (ch == 'y' || ch == 'Y'){
322.                      booking();
323.                }else{
324.                      cout<<endl<<endl<<"\t\tThank You !";
325.                      rail();
326.                }
327.            }
328.      }
```

```
329.
330.       int main()
331.       {
332.           system("Color C0");
333.           railway ob;
334.           ob.rail();
335.           return 0;
336.       }
```

❖ C++ OUTPUT: -

```
                              ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
                              .......WELCOME TO RAILWAY RESERVATION SYSTEM....
                              ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~



^^^^^^^^^^^^^^^^^^^^^^^^MAIN MENU^^^^^^^^^^^^^^^^^^^^^
1. Check Status
2. Online Seat booking
3. Exit

# Enter your choice: 1




                              ********************************************
                                    ** CHECK YOUR STATUS HERE **
                              ********************************************


By what means you want to check your status
1. Adhar number
2. Name
Enter your choice here: 1


# Enter last 3 digits of your registered adhar number to check the status:- 002


 Oops! It seems you are not registered

 Do you wanna register your self(y/n) [Enter n to return to main menu]: y

                                  ********************************************
                                      **WELCOME TO THE SEAT BOOKING MENU**
                                  ********************************************


   ^^^^^^^^^^^^^^^^^^^^^^^Check before proceeding^^^^^^^^^^^^^^^^^^^^
   1. Continue
   2. Back
   3. Exit

   # Enter your choice: 1


   # How many seats you want to book: 2


   # Enter the user 1 details


   ~ Enter your name:- Harsh


   ~ Enter your age:- 21


   ~ Enter the last 3 digits of your adhar number:- 002
```

```
~ Choose Reservation quota:
1. GENERAL
2. Tatkal
3. Premium Tatkal

 Enter your choice: 1


~ Enter the train number:- 1234


~ Enter Journey from:- UJN


~ Enter Journey to:- IDR


~ Choose Class:
1. Sleeper
2. 3rd AC
3. 2nd AC
4. 1st AC

 Enter your choice: 1


~ Enter departure date(DD/MM/YYYY):- 02/05/2021


~ DO YOU WANT TO REVIEW FORM (y/n) [Press n to directly submit]:- n


=> Thank you for seat booking with us. Your seat has been booked and your seat number is: 2


# Enter the user 2 details


~ Enter your name:- Tadeeb


~ Enter your age:- 22


~ Enter the last 3 digits of your adhar number:- 125


~ Choose Reservation quota:
1. GENERAL
2. Tatkal
3. Premium Tatkal

 Enter your choice: 1


~ Enter the train number:- 1234


~ Enter Journey from:- UJN


~ Enter Journey to:- IDR


~ Choose Class:
1. Sleeper
2. 3rd AC
3. 2nd AC
4. 1st AC

 Enter your choice: 2

 ~ Enter departure date(DD/MM/YYYY):- 02/05/2021


 ~ DO YOU WANT TO REVIEW FORM (y/n) [Press n to directly submit]:- y


                ^^^^^^^^^^^^^^^^^^^^^^ Review ^^^^^^^^^^^^^^^^^^^^

                Name:        Tadeeb
                Age:         22
                Adhar nos:   125
                Quota:       General
                Train nos:   1234
                JOUR_From:   UJN
                JOUR_to:     IDR
                Class:       3rd AC
                Dep_Date:    02/05/2021

 ~ Enter Y to submit or Enter M to Modify the details :- M
```

```
                ***********Enter details again***********


 ~ Enter your name:- Tadeeb


 ~ Enter your age:- 21


 ~ Enter the last 3 digits of your adhar number:- 125


 ~ Choose Reservation quota:
 1. GENERAL
 2. Tatkal
 3. Premium Tatkal

  Enter your choice: 1


 ~ Enter the train number:- 1234


 ~ Enter Journey from:- UJN


 ~ Enter Journey to:- BPL


 ~ Choose Class:
 1. Sleeper
 2. 3rd AC
 3. 2nd AC
 4. 1st AC

  Enter your choice: 4


 ~ Enter departure date(DD/MM/YYYY):- 02/05/2021


 ~ DO YOU WANT TO REVIEW FORM (y/n) [Press n to directly submit]:- y



               ^^^^^^^^^^^^^^^^^^^^^^ Review ^^^^^^^^^^^^^^^^^^^^

               Name:        Tadeeb
               Age:         21
               Adhar nos:   125
               Quota:       General
               Train nos:   1234
               JOUR_From:   UJN
               JOUR_to:     BPL
               Class:       1st AC
               Dep_Date:    02/05/2021

~ Enter Y to submit or Enter M to Modify the details :- Y


=> Thank you for seat booking with us. Your seat has been booked and your seat number is: 6


# Do you want to return to main menu(y/n):-
(Press y to continue)
(Press n to exit)
:- y


                              ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
                              .......WELCOME TO RAILWAY RESERVATION SYSTEM....
                              ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~


^^^^^^^^^^^^^^^^^^^^^^^^MAIN MENU^^^^^^^^^^^^^^^^^^^^
1. Check Status
2. Online Seat booking
3. Exit

# Enter your choice: 2
```

```
                                  ********************************************
                                      **WELCOME TO THE SEAT BOOKING MENU**
                                  ********************************************


   ^^^^^^^^^^^^^^^^^^^^^^Check before proceeding^^^^^^^^^^^^^^^^^^^^
   1. Continue
   2. Back
   3. Exit

   # Enter your choice: 1


   # How many seats you want to book: 1


   # Enter the user 1 details


   ~ Enter your name:- Kamal


   ~ Enter your age:- 22


   ~ Enter the last 3 digits of your adhar number:- 002


   ~ Choose Reservation quota:
   1. GENERAL
   2. Tatkal
   3. Premium Tatkal

    Enter your choice: 2

  ~ Enter the train number:- 1234


  ~ Enter Journey from:- UJN


  ~ Enter Journey to:- BPL


  ~ Choose Class:
  1. Sleeper
  2. 3rd AC
  3. 2nd AC
  4. 1st AC

   Enter your choice: 2


  ~ Enter departure date(DD/MM/YYYY):- 02/05/2021


  ~ DO YOU WANT TO REVIEW FORM (y/n) [Press n to directly submit]:- n


  You are in the waiting list.

                                  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
                                  .......WELCOME TO RAILWAY RESERVATION SYSTEM....
                                  ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~



^^^^^^^^^^^^^^^^^^^^^^MAIN MENU^^^^^^^^^^^^^^^^^^^^
1. Check Status
2. Online Seat booking
3. Exit

# Enter your choice: 1




                                  ********************************************
                                        ** CHECK YOUR STATUS HERE **
                                  ********************************************


By what means you want to check your status
1. Adhar number
2. Name
Enter your choice here: 2
```

```
# Enter your registered name to check the status:- Harsh

=> Your seat has been booked successfully !. Your details are:

YOUR SEAT NUMBER IS 2 AND OTHER DETAILS ARE:

                ^^^^^^^^^^^^^^^^^^^^^^ Review ^^^^^^^^^^^^^^^^^^^^
                Name:        Harsh
                Age:         21
                Adhar nos:   2
                Quota:       General
                Train nos:   1234
                JOUR_From:   UJN
                JOUR_to:     IDR
                Class:       Sleeper
                Dep_Date:    02/05/2021


 # Do you want to return to main menu(y/n):-
 (Press y to continue)
 (Press n to exit)
 :- y

                              ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
                              .......WELCOME TO RAILWAY RESERVATION SYSTEM....
                              ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~


 ^^^^^^^^^^^^^^^^^^^^^^^^MAIN MENU^^^^^^^^^^^^^^^^^^^^
 1. Check Status
 2. Online Seat booking
 3. Exit

 # Enter your choice: 1


                              ********************************************
                                   ** CHECK YOUR STATUS HERE **
                              ********************************************


 By what means you want to check your status
 1. Adhar number
 2. Name
 Enter your choice here: 1


 # Enter last 3 digits of your registered adhar number to check the status:- 002


 => Your seat has been booked successfully !. Your details are:


 YOUR SEAT NUMBER IS 2 AND OTHER DETAILS ARE:

                 ^^^^^^^^^^^^^^^^^^^^^^ Review ^^^^^^^^^^^^^^^^^^^^
                 Name:        Harsh
                 Age:         21
                 Adhar nos:   2
                 Quota:       General
                 Train nos:   1234
                 JOUR_From:   UJN
                 JOUR_to:     IDR
                 Class:       Sleeper
                 Dep_Date:    02/05/2021
--------------------------
```

❖ Conclusion:

Hence upon doing this project I was able to understand why we do hashing and what is its main purpose. Hence the purpose of using hashing is to perform all the operation such as insert, delete, modify and access should occur in a constant time or O (1).