Algorithms Report 3

(Movie Reservation System)

Ⅰ. Introduction

1. Purpose of the system

   This system is designed to assist movie reservation. This system provides some functions: checking movie schedule, reservation, reservation cancellation.

2. Input and output

   A. Reservation

      i. Input: movie id, date, movie start time, seat number

      ii. Output: reservation id, reserved movie id, date, start time, seat number, updated seat layout

   B. Reservation cancellation

      i. Input: reservation id

      ii. Output: reservation cancellation confirmation comment, cancelled reservation id, updated seat layout

3. How the rb-trees are constructed

   A. Data structure

      i. Node

         This data structure stores information of reservation. It contains movie id, movie start time, movie showing date, seat number, and color for red-black tree. It also has parent, left, right nodes of red-black tree.

      ii. RBTree

         This data structure stores reservation nodes. It points other reservations by using pointer.

   B. Function

      i. createNode

         This function creates node by reservationId received by parameter. Set other

elements of Node (parent, left, right, movid id, start time, date, seat num) as NULL and color as 'R'(means red).

ii. createRBTree

This function creates red-black tree and set root node and nil node. And, return red-black tree pointer.

iii. RBTreeInsert

This function inserts node to red-black tree. It sorts by reservation id.

iv. RBTreeDelete

This function deletes node by value(key of red-black tree) received by parameter.

4. Additional data structure

A. movieSchedule

This data structure stores information of movies. It contains movie id, movie start time, movie showing date, and red-black tree that contains information of reservation.

B. queueNode

This data is element of queue. It contains node which represents reservation information and next queueNode pointer.

C. Queue

This data stores queueNodes. It contains front queueNode pointer and rear queueNode pointer.

5. Important functions

A. printTree

This function prints nodes of red-black tree by level using DFS. First, make queue and enqueue (insert at the end of the queue) root node of red-black tree to the queue. Print level of the tree. Next, dequeue (delete first element of the queue) the node and print the value (reservation id) of the node and enqueue the left and right node of dequeued node in turn by iterating all elements of the queue. Then, increase level by 1. Repeats this process while queue is not empty.

B. findMovieId

This function find movie which user finds. It receives movie id, start time, showing data as parameters and finds movieSchedule data structure's pointer by comparing movie id, start time, and date while searching 2d array of movieSchedule.

C. makeMovieSchedule

This function creates some movies and stores all the movies in 2d array. And generate movie id, start time, date randomly and store information at movieSchedule structure.

D. printSeatLayout

This function prints seat layout of the movie by chart. It shows seat number and state of the seat number. "X" means the seat is already occupied. Black means the seat is vacant.

E. printMovieSchedule

This function prints movie schedule of the week by chart. It shows movie id and movie start time according to date. Also, it prints seat layout of each movies.

F. reservation

This function makes reservation. It receives movie id, movie start time, movie showing date, and seat number as parameters and generates reservation id. Reservation id consists of {month}{day}{start time}{movie id}{seat number}. And it creates node by reservation id (reservation id being key) and inserts this node to red-black tree which represents reservation of the movie user chose. Finally, print red-black tree.

G. reservationInput

This function receives some information for reservation from users. It takes movie id, movie showing date, movie start time as input. And it finds movie which satisfies the condition that user choose and shows seat layout. When the movie which satisfies the condition that user choose exists, it receives seat number as a input. When the seat the user choose is vacant, it calls reservation function. Finally, it prints updated red-black tree, reservation confirmation information (reservation id, reserved movie id, date, start time, seat number) and updated seat layout. Otherwise, when the seat is occupied, it prints "the seat is already reserved" message.

H. reservationCancellation

This function cancels reservation. It receives reservation id as parameters and deletes

node from the red-black tree. Finally, print reservation cancellation confirmation information (reservation id) and updated red-black tree and updated seat layout.

I. reservationCancellationInput

This function receives some information for reservation cancellation from users. It takes reservation id as a input. And it finds movie the user reserved and print red-black tree of that movie. When the reservation id is valid, it calls reservationCancellation function. Otherwise, when the reservation id is invalid, it prints "Your reservation Id doesn't exist" message.

J. reservationConfirmation

This function confirms reservation. It takes reservation id as a input. When the reservation id is valid, it prints information of the reservation (movie id, day, start time, seat number). Otherwise, when the reservation id is invalid, it prints "Your reservation Id doesn't exist" message.

K. menuselect

This function receives the menu which user choose. It provides 4 menus in order: check movie schedule, reservation, reservation cancellation, and finish. When user enters "1", it calls printMovieSchedule function and menuselect function in turn. When user enters "2", it calls reservationInput function and menuselect function in turn. When user enters "3", it call reservationCancellationInput function and menuselect function in turn. When user enter "4", it prints finishing message and finish the system. When the user enters values except the numbers mentioned above.

6. Range of values

A. Movie Id: "100", "200", "300", "400", "500" are stored in array.

B. Movie showing date: "12/03", "12/04", "12/05", "12/06", "12/07", "12/08", "12/09" are stored in array.

C. Movie start time: "10:00", "12:00", "15:00", "18:00", "21:00" are stored in array.

D. Seat Number: real number from 1 to 200.

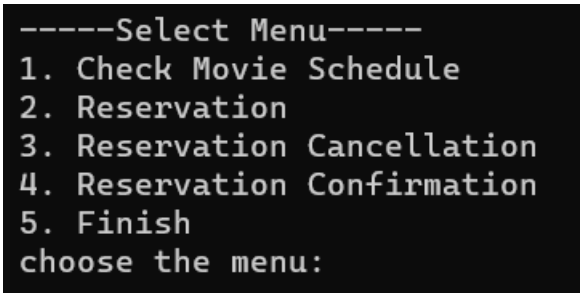
7. Random values generation

First, create array of 60(30% of seat number) numbers range from 1 to 200 by iterating all movies. Therse 60 numbers become seat number. And movie start time and movie showing date is decided uniquely by certain movie.

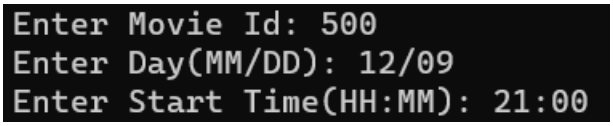
Ⅱ. User Interface Description

1. Exact inputs

   First, select menu.



   A. Reservation



      Enter movie id, showing day(MM/DD) of the movie, and start time(HH/MM).

      Enter seat number.

   B. Reservation Cancellation

      Enter reservation id.

   C. Reservation Confirmation

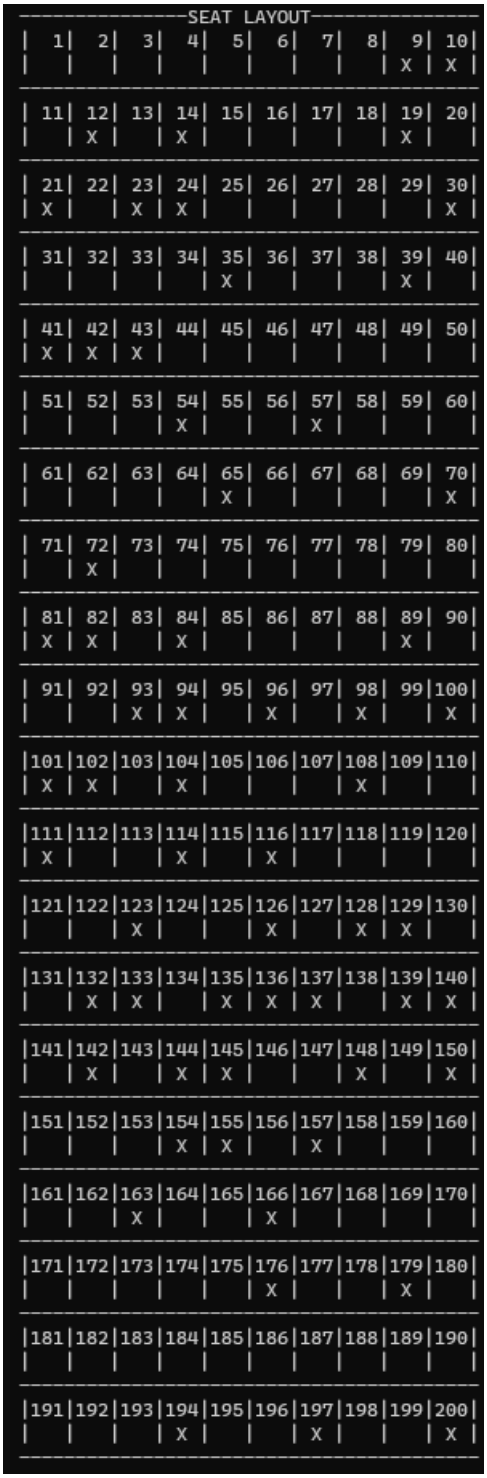
      Enter reservation id.

2. Exact outputs

   A. Reservation

i. Seat number is valid (user choose vacant seat)

```
***Your reservation is completed successfully!***
Reservation Id: 120921500200
Movie Id: 500
Day: 12/09
Start Time: 21
Seat Number: 200
```



```
----------SEAT LAYOUT----------
|  1|  2|  3|  4|  5|  6|  7|  8|  9| 10|
|   |   |   |   |   |   |   |   | X | X |
-----------------------------------------
| 11| 12| 13| 14| 15| 16| 17| 18| 19| 20|
|   | X |   | X |   |   |   |   | X |   |
-----------------------------------------
| 21| 22| 23| 24| 25| 26| 27| 28| 29| 30|
| X |   | X | X |   |   |   |   |   | X |
-----------------------------------------
| 31| 32| 33| 34| 35| 36| 37| 38| 39| 40|
|   |   |   |   | X |   |   |   | X |   |
-----------------------------------------
| 41| 42| 43| 44| 45| 46| 47| 48| 49| 50|
| X | X | X |   |   |   |   |   |   |   |
-----------------------------------------
| 51| 52| 53| 54| 55| 56| 57| 58| 59| 60|
|   |   |   | X |   |   | X |   |   |   |
-----------------------------------------
| 61| 62| 63| 64| 65| 66| 67| 68| 69| 70|
|   |   |   |   | X |   |   |   |   | X |
-----------------------------------------
| 71| 72| 73| 74| 75| 76| 77| 78| 79| 80|
|   | X |   |   |   |   |   |   |   |   |
-----------------------------------------
| 81| 82| 83| 84| 85| 86| 87| 88| 89| 90|
| X | X |   | X |   |   |   |   | X |   |
-----------------------------------------
| 91| 92| 93| 94| 95| 96| 97| 98| 99|100|
|   |   | X | X |   | X |   | X |   | X |
-----------------------------------------
|101|102|103|104|105|106|107|108|109|110|
| X | X |   | X |   |   |   | X |   |   |
-----------------------------------------
|111|112|113|114|115|116|117|118|119|120|
| X |   |   | X |   | X |   |   |   |   |
-----------------------------------------
|121|122|123|124|125|126|127|128|129|130|
|   |   | X |   |   | X |   | X | X |   |
-----------------------------------------
|131|132|133|134|135|136|137|138|139|140|
|   | X | X |   | X | X | X |   | X | X |
-----------------------------------------
|141|142|143|144|145|146|147|148|149|150|
|   | X |   | X | X |   |   | X |   | X |
-----------------------------------------
|151|152|153|154|155|156|157|158|159|160|
|   |   |   | X | X |   | X |   |   |   |
-----------------------------------------
|161|162|163|164|165|166|167|168|169|170|
|   |   | X |   |   | X |   |   |   |   |
-----------------------------------------
|171|172|173|174|175|176|177|178|179|180|
|   |   |   |   |   | X |   |   | X |   |
-----------------------------------------
|181|182|183|184|185|186|187|188|189|190|
|   |   |   |   |   |   |   |   |   |   |
-----------------------------------------
|191|192|193|194|195|196|197|198|199|200|
|   |   |   | X |   |   | X |   |   | X |
-----------------------------------------
```

Reservation information (movie id, showing day of the movie, start time, seat number) and updated seat layout is printed.

ii. Seat number is invalid (user choose occupied seat)

```
The seat is already reserved. Choose the menu again.
-----Select Menu-----
1. Check Movie Schedule
2. Reservation
3. Reservation Cancellation
4. Reservation Confirmation
5. Finish
choose the menu:
```

Print message and select menu again.

B. Reservation Cancellation

i. Reservation id is valid

```
***Your reservation is cancelled successfully!***
Cancelled Reservation Id: 120921500200
```

```
-------------SEAT LAYOUT-------------
|  1|  2|  3|  4|  5|  6|  7|  8|  9| 10|
| x |   |   |   |   |   |   | x |   |   |
-------------------------------------------
| 11| 12| 13| 14| 15| 16| 17| 18| 19| 20|
|   | x |   |   |   | x | x | x | x |   |
-------------------------------------------
| 21| 22| 23| 24| 25| 26| 27| 28| 29| 30|
|   |   |   |   | x |   |   |   |   |   |
-------------------------------------------
| 31| 32| 33| 34| 35| 36| 37| 38| 39| 40|
|   |   |   | x | x | x | x | x |   |   |
-------------------------------------------
| 41| 42| 43| 44| 45| 46| 47| 48| 49| 50|
| x |   | x | x |   | x |   |   | x |   |
-------------------------------------------
| 51| 52| 53| 54| 55| 56| 57| 58| 59| 60|
|   |   | x |   |   |   |   | x | x |   |
-------------------------------------------
| 61| 62| 63| 64| 65| 66| 67| 68| 69| 70|
| x |   | x | x | x |   |   |   |   |   |
-------------------------------------------
| 71| 72| 73| 74| 75| 76| 77| 78| 79| 80|
| x |   |   |   |   | x | x |   |   | x |
-------------------------------------------
| 81| 82| 83| 84| 85| 86| 87| 88| 89| 90|
|   | x |   |   | x | x | x |   |   |   |
-------------------------------------------
| 91| 92| 93| 94| 95| 96| 97| 98| 99|100|
|   |   | x |   |   |   |   |   | x |   |
-------------------------------------------
|101|102|103|104|105|106|107|108|109|110|
| x |   |   |   |   |   |   |   |   |   |
-------------------------------------------
|111|112|113|114|115|116|117|118|119|120|
|   |   |   | x |   |   |   |   |   | x |
-------------------------------------------
|121|122|123|124|125|126|127|128|129|130|
| x |   |   |   |   |   |   |   | x | x |
-------------------------------------------
|131|132|133|134|135|136|137|138|139|140|
|   |   |   |   |   |   |   |   |   | x |
-------------------------------------------
|141|142|143|144|145|146|147|148|149|150|
|   |   |   |   |   |   | x |   |   | x |
-------------------------------------------
|151|152|153|154|155|156|157|158|159|160|
| x |   | x |   |   | x |   | x |   | x |
-------------------------------------------
|161|162|163|164|165|166|167|168|169|170|
| x | x |   | x |   |   | x | x |   |   |
-------------------------------------------
|171|172|173|174|175|176|177|178|179|180|
|   |   |   |   |   |   | x |   | x | x |
-------------------------------------------
|181|182|183|184|185|186|187|188|189|190|
|   | x |   |   | x |   |   |   |   |   |
-------------------------------------------
|191|192|193|194|195|196|197|198|199|200|
|   |   |   | x |   |   |   |   |   |   |
-------------------------------------------
```

Cancelled reservation information (reservation id) and updated seat layout is printed.

ii. Reservation id is invalid

```
Your reservation Id doesn't exist. Choose the menu again.
-----Select Menu-----
1. Check Movie Schedule
2. Reservation
3. Reservation Cancellation
4. Reservation Confirmation
5. Finish
choose the menu:
```

Print message and select menu again.

C. Reservation Confirmation

i. Reservation id is valid

```
***Your Reservation Information***
Reservation Id: 120921500194
Movie Id: 500
Day: 12/09
Start Time: 21:00
Seat Number: 194
```

Print reservation information (reservation id, movie id, showing day of the movie, start time, seat number)

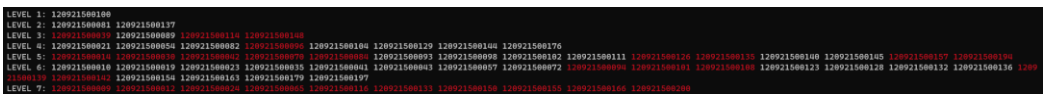
ii. Reservation id is invalid

```
Your reservation Id doesn't exist.
-----Select Menu-----
1. Check Movie Schedule
2. Reservation
3. Reservation Cancellation
4. Reservation Confirmation
5. Finish
choose the menu:
```

Print message and select menu again.

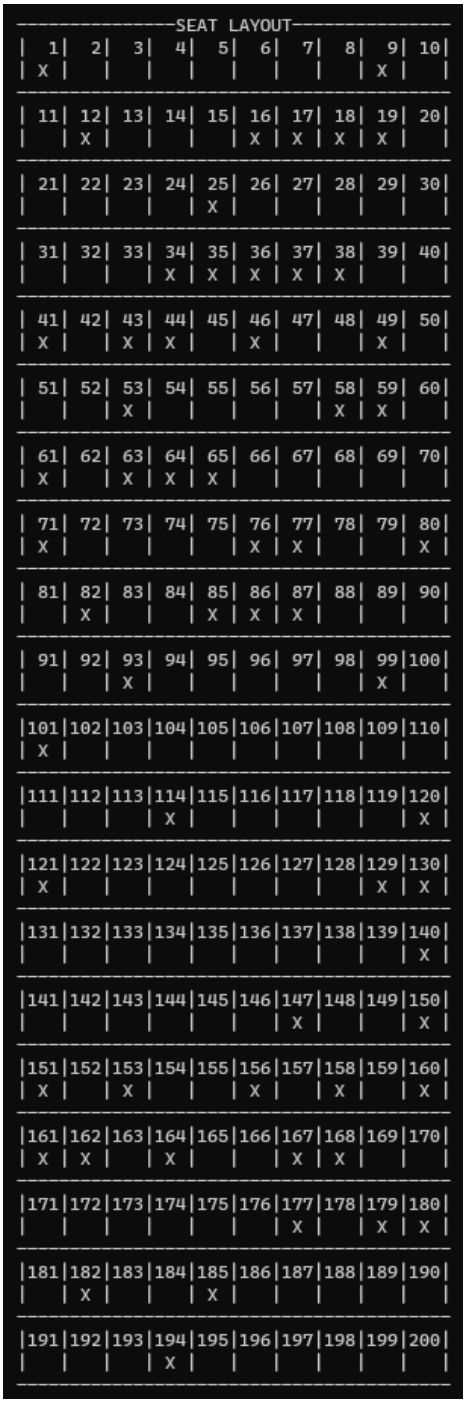
3. Display

A. Reservation information



Reservation id is displayed.

B. Seat layout



Seat layout is displayed.

Ⅲ. Conclusions

1. Assumptions

I assume movie schedule of a week (7days) and date as 12/03 – 12/09 and 5 movies are shown per day. And, there are 5 movies.

2. Significances

   I only assume 5 movies are shown in a week. So, same movies are shown in different date and time several times. It accurately reflects reality movie industry,

3. Limitations

   I do not consider multiplex theater. Also, I do not consider the user who wants to reserve more than 2 seats at once.

4. Future works

   System will be better if it overcomes limitations mentioned above. Also, when system provides some functions like language selection, payments or recommendation by the comments of other users.