

#### **Project Idea**

An application to provide a car rental service, which can be rented for a day or for several monthsTHIS APP FORFor customers who want to rent a carFor employees of a car rental company.









#### **Used Data Structure:**



01

1 Array List

Class Employees

2 Linked List

Clss Cars, Class CustomerQueueList 02

1 Queue
Class CustomerQueueList







### **Array List**

- **Empoloyees** 
  - **Used algorithms**:
  - 1- Insertion sort Algrothim to sort employees first namesO(n^2)
  - 2- merge sort algorithm to sort employees first namesO(nlogn)







#### LinkedList



- 1- Insertion sort Algrothim to sort Cars Car make O(n^2)
- 2- merge sort algorithm to sort Cars
  Car make O(nlogn)
- 3- leaner search algorithm to search for car using registration number O(n)
- 4- linear recursion sum To calculate the expected daily, monthly and yearly profit of the company



**Used To store customer rentals** 



#### Queue

- CustomerQueueList algorithms:
  - 1- Insertion sort Algrothim to sort cutomer by name  $O(n^2)$
  - 2- Recursion Algrothimto calculate the total rental price Cars
  - 3- leaner search algorithm to search for customer O(n)







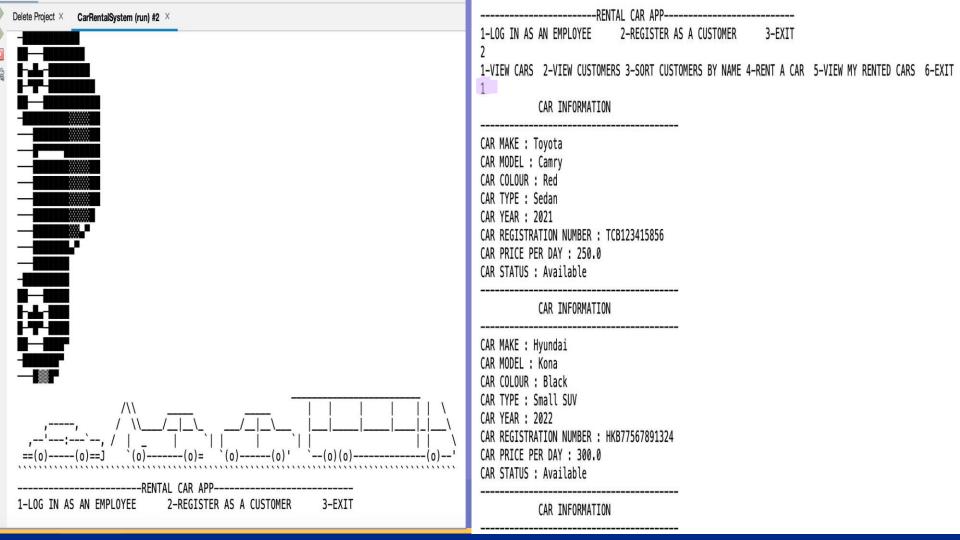




1-LOG IN AS AN EMPLOYEE 2-REGISTER AS A CUSTOMER 3-EXIT	1-VIEW CARS 2-UPDATE CAR STATUS 3- VIEW AND SORT EMPLOYEES 4- VIEW AND SORT CARS 5-VIEW POTENTIAL PROF
1	2
ENTER YOUR USERNAME:	ENTER THE CAR REGISTRATION NUMBER :
user1	0PP612345544
ENTER YOUR PASSWORD:	ENTER THE CAR STATUS :
1234	Available
WELLCOME FARAH	
1-VIEW CARS 2-UPDATE CAR STATUS 3- VIEW AND SORT EMPLOYEES 4- VIEW AND SORT CARS 5-VIEW POTENTIAL PROF	1-VIEW CARS 2-UPDATE CAR STATUS 3- VIEW AND SORT EMPLOYEES 4- VIEW AND SORT CARS 5-VIEW POTENTIAL PROF
1	3
CAR INFORMATION	PLEAASE CHOOSE THE PREFERRED ALGROTHIM TO SORT THE NAMES
VIII 211 (1911) 2011	1- MERGE SORT ALGROTHIM 2- INSERT SORT ALGROTHIM 3-EXIT
CAR MAKE : Toyota	1
CAR MODEL : Camry	Abigail
CAR COLOUR : Red	Abraham
CAR TYPE : Sedan	Adam
CAR YEAR : 2021	Aida
CAR REGISTRATION NUMBER : TCB123415856	Aiden
CAR PRICE PER DAY: 250.0	Alberta
CAR STATUS : Available	Alen
	Alexander
CAR INFORMATION	Alford
	Alina
CAR MAKE : Hyundai	Alina
CAR MODEL : Kona	Alissa
CAR COLOUR : Black	Amber
CAR TYPE : Small SUV	Anna
CAR YEAR : 2022	Antony
CAR REGISTRATION NUMBER : HKB77567891324	Arianna
and products only fixed ( ##11 Million )	

# OUTPUT OF REGISTER AS A CUSTOMER





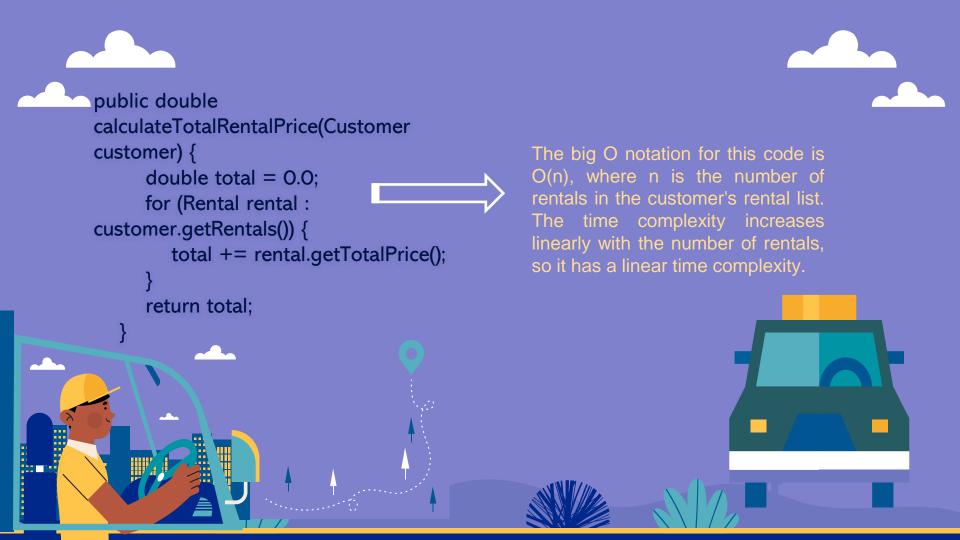
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Name: Fatima Ahmed, License Number: 2345678, Address: King Abdulaizz Road, Jeddah, Saudi Arabia, Phone Number: 0153555 Name: Abdullah, License Number: 8901234, Address: King Faisal Street, Damman, Saudi Arabia, Phone Number: 0153555 Name: Sanira Ali, License Number: 9012345, Address: King Faisal Street, Damman, Saudi Arabia, Phone Number: 0153555 Name: Sanira Ali, License Number: 9012345, Address: Salam Street, Sania's, Phone Number: 0153555 Name: Sanira Ali, License Number: 567890, Address: Champs-Élysées, Paris, France, Phone Number: 0111111111 Name: Noir ElDin Nahmoud, License Number: 567890, Address: Tahlia Street, Amman, Jordan, Phone Number: 01111111111 Name: Noir ElDin Nahmoud, License Number: 6789012, Address: Al-Hasheni Street, Baghdad, Iraq, Phone Number: 01111111111 Name: Noir ElDin Nahmoud, License Number: 6789012, Address: Renarald Street, Cairo, Egypt, Phone Number: 01111111111 Name: Noir ElDin Nahmoud, License Number: 6789012, Address: Nahid Bin Naleed Avenue, Manama, Bahrain, Phone Number: 01111111111 Name: Alia Abdullah, License Number: 6789012, Address: Nahid Bin Naleed Avenue, Manama, Bahrain, Phone Number: 01111111111 Name: Noir ElDin Nahmoud, License Number: 3456789, Address: Specialized Street, Riyadh, Saudi Arabia, Phone Number: 0111111111111111111111111111111111111		3
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Total Rental Price: 0.0  Name: Zainab Ali, License Number: 901234, Address: Sheikh Rashid Street, Abu Dhabi, United Arab Emirates, Phon Name: Mariam Ammar, License Number: 1234567, Address: Gulf Street, Doha, Qatar, Phone Number: 0978965432  Total Rental Price: 0.0  Name: Saud Mohammed, License Number: 2345678, Address: Sea Street, Jeddah, Saudi Arabia, Phone Number: 055555  Total Rental Price: 0.0  Name: Saud Mohammed, License Number: 2345678, Address: Sea Street, Jeddah, Saudi Arabia, Phone Number: 0505555  Total Rental Price: 0.0  Name: Saud Mohammed, License Number: 2345678, Address: Sea Street, Jeddah, Saudi Arabia, Phone Number: 0505555  Total Rental Price: 0.0  Name: Lama Abdullah, License Number: 3456789, Address: Prince Sultan Street, Riyadh, Saudi Arabia, Phone Number: 0505555  Total Rental Price: 0.0  Total Rental Price: 0.0  Name: Saud Mohammed, License Number: 2345678, Address: Sea Street, Jeddah, Saudi Arabia, Phone Number: 0505555  Name: Saud Mohammed, License Number: 2345678, Address: Sea Street, Jeddah, Saudi Arabia, Phone Number: 0505555  Total Rental Price: 0.0  Name: Cainab Ali, License Number: 678901, Address: Hamra Street, Tripoli, Libya, Phone Number: 0912345678  Name: Nour ElDin Mahmoud, License Number: 4567890, Address: Nile Street, Khartoum, Sudan, Phone Number: 0912345678  Name: Samira Ali, License Number: 1234567, Address: Square Street, Riyadh, Saudi Arabia, Phone Number: 0505555  Name: Saud Mohammed, License Number: 2345678, Address: Sea Street, Jeddah, Saudi Arabia, Phone Number: 0505555  Name: Youssef Ibrahim, License Number: 901234, Address: Sheikh Rashid Street, Abu Dhabi, United Arab Emirates, Phon 1-VIEW CARS 2-VIEW CUSTOMERS BY NAME 4-RENT A CAR 5-VIEW MY RENTED CARS 6-EXIT		
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1-VIEW CARS 2-VIEW CUSTOMERS 3-SORT CUSTOMERS BY NAME 4-RENT A CAR 5-VIEW MY RENTED CARS 6-EXIT  4 Enter the customer license number that you want to Rent 2345678 BITER THE REGISTRATION NUMBER OF THE CAR YOU WANT TO RENT DVH145678956 ENTER THE RETURN DATE IN THIS FORMMAT MM/DD/YYYY 2/22/2023 ENTER THE RETURN DATE IN THIS FORMMAT MM/DD/YYYY 3/22/2023 CAR MAKE: GMC CAR MODEL: GMC CAR COLOUR: Red CAR COLOUR: Red CAR YEAR: 2023 CAR REGISTRATION NUMBER: DVH145678956 CAR PICE PER DAY: 250.0 CAR REGISTRATION NUMBER: DVH145678956 CAR PICE PER DAY: 250.0 CAR RENTAL DATE OUT: 2/22/2023 5 CAR RENTAL DATE RETURN: 3/22/2023	Name: Lama Abdullah, License Number: 3456789, Address: Prince Sultan Street, Riyadh, Saudi Arabia, Phone Number Name: Mariam Ali, License Number: 3456789, Address: Specialized Street, Riyadh, Saudi Arabia, Phone Number: 05 Name: Mariam Ammar, License Number: 1234567, Address: Gulf Street, Doha, Qatar, Phone Number: 0978965432 Name: Mohammed Abdullah, License Number: 345678, Address: Sheikh Zayed Road, Dubai, United Arab Emirates, Phon Name: Nour ElDin Mahmoud, License Number: 678901, Address: Hamra Street, Tripoli, Libya, Phone Number: 0922222 Name: Omar Hussein, License Number: 4567890, Address: Nile Street, Khartoum, Sudan, Phone Number: 0912345678 Name: Reem Abdullah, License Number: 789012, Address: University Street, Riyadh, Saudi Arabia, Phone Number: 0 Name: Samira Ali, License Number: 456789, Address: Champs-Élysées, Paris, France, Phone Number: 0123456789 Name: Sara Mohammed, License Number: 1234567, Address: Square Street, Riyadh, Saudi Arabia, Phone Number: 0505555 Name: Saud Mohammed, License Number: 2345678, Address: Sea Street, Jeddah, Saudi Arabia, Phone Number: 0505555 Name: Youssef Ibrahim, License Number: 8901234, Address: Andalus Street, Muscat, Oman, Phone Number: 95888888 Name: Zainab Ali, License Number: 901234, Address: Sheikh Rashid Street, Abu Dhabi, United Arab Emirates, Phon	ENTER THE REGISTRATION NUMBER OF THE CAR YOU WANT TO RENT DVH145678956 ENTER THE RENTAL DATE IN THIS FORMMAT MM/DD/YYYY 2/22/2023 ENTER THE RETURN DATE IN THIS FORMMAT MM/DD/YYYY 3/22/2023 7000.0 CARD NUMBER: 22209374563 CARDHOLDER NAME: asayelamal
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	5	







```
public void insertionSort( ArrayList <</pre>
Employees> a ){
      int i, j, k;
      Employees temp;
      for (i = 1; i < a.size(); i++){
         temp = a.get(i);
      for (j = 0; j < i; j++) {
          if (a.get(i).compareTo(temp) >
a.get(i).compareTo(a.get(j))) {
             break; }
      for (k = i; k > j; k--) {
          a.set(k, a.get(k-1));
       a.set(j,temp); }
```

The worst-case time complexity for this insertion sort algorithm is O(n^2), where n is the size of the input array. The total number of comparisons and swaps is roughly (1/2)n^2, which gives us a quadratic time complexity.



## comparison

We use this method:

long startTime = System.currentTimeMillis();

long endTime =System.currentTimeMillis();

long elapsed = end Time - startTime;

To compare between insert sort algrothim and merge sort algrothem on linked list and array list





# comparison



	ArrayList		LinkedList	
	Merge	Insert	Merge	Insert
Big O	O(nlog <sub>2</sub> n)	O(n <sup>2</sup> )	$O(n\log_2 n)$	O(n <sup>2</sup> )
Rin time	21386300/5 = 4277260	28508200/5 =5701640	12370300/5 =2474060	10112600/5 = 5056300

#### Based on the schedule:

- 1-merge sort algorithm is better than insert sort algorithm.
  - 2- linked list is better than array list in sorting.