

## **Lab Assignment-12.5**

# **Algorithms with AI Assistance – Sorting, Searching, and Optimizing Algorithms**

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### **Task Description #1 (Sorting – Merge Sort Implementation)**

- **Task:** Use AI to generate a Python program that implements the Merge Sort algorithm.

**Prompt:** #Generate a python code to create a function merge\_sort(arr) that sorts a list in ascending order. Give time complexity and space complexity of the code in comments, use pydoc to generate documentation

## Code:

```
> User > chari > OneDrive > Desktop > AI Assistant coding > lab125.py > merge_sort
1 #Generate a python code to create a function merge_sort(arr) that sorts a list in ascending order.Give time complexity and space complexity of the code in comments, use pydoc to generate documentation
2 def merge_sort(arr):
3     """
4         This function implements the merge sort algorithm to sort a list in ascending order.
5         Merge sort is a divide-and-conquer algorithm that divides the input list into two halves,
6         recursively sorts both halves, and then merges the sorted halves back together.
7         Parameters:
8             arr (list): The list of elements to be sorted.
9             Returns:
10                list: A new list containing the sorted elements in ascending order.
11                Time complexity: O(n log n) - where n is the number of elements in the list. This is because the list is divided log n times and each merge operation takes O(n) time.
12                Space complexity: O(n) - due to the additional space required for the temporary arrays used during the merge process.
13                Example:
14                    >>> merge_sort([38, 27, 43, 3, 9, 82, 10])
15                    [3, 9, 10, 27, 38, 43, 82]
16                    >>> merge_sort([5, 2, 9, 1, 5, 6])
17                    [1, 2, 5, 5, 6, 9]
18                    >>> merge_sort([])
19                    []
20                    >>> merge_sort([1])
21                    [1]
22                    """
23
24        if len(arr) <= 1:
25            return arr
26        # Split the array into two halves
27        mid = len(arr) // 2
28        left_half = merge_sort(arr[:mid]) # Recursively sort the left half
29        right_half = merge_sort(arr[mid:]) # Recursively sort the right half
30        # Merge the sorted halves
31        return merge(left_half, right_half)
32    def merge(left, right):
33        """This helper function merges two sorted lists into a single sorted list.
34        Parameters:
35            left (list): The first sorted list.
36            right (list): The second sorted list.
37            Returns:
38                list: A merged sorted list containing all elements from both input lists.
39                """
40        merged = []
41        i = j = 0
42        # Merge the two lists while maintaining sorted order
43        while i < len(left) and j < len(right):
44            # use the __lt__ comparison (or left[i].time < right[j].time)
45            if left[i] < right[j]:
46                merged.append(left[i]) # Append the smaller element from left
47                i += 1
48            else:
49                merged.append(right[j]) # Append the smaller element from right
50                j += 1
51        # If there are remaining elements in left, add them to merged
52        while i < len(left):
53            merged.append(left[i])
54            i += 1
55        # If there are remaining elements in right, add them to merged
56        while j < len(right):
57            merged.append(right[j])
58            j += 1
59        return merged # Return the merged sorted list
60 print("Sorted list:", merge_sort([38, 27, 43, 3, 9, 82, 10])) # Example usage of the merge_sort function to sort a list of numbers
61 print("Time complexity: O(n log n)") # Print the time complexity of the merge sort algorithm
62 print("Space Complexity: O(n)") # Print the space complexity of the merge sort algorithm
63
```

## Output:

```
Sorted list: [3, 9, 10, 27, 38, 43, 82]
```

**Explanation:** The code snippet implements a function to check if a given number is a palindrome. It converts the number to a string and compares it with its reverse to determine if it reads the same backward and forward. The function includes a docstring that explains its purpose, parameters, return value, and provides examples of usage.

## Task Description #2 (Searching – Binary Search with AI)

## Optimization)

- **Task:** Use AI to create a binary search function that finds a target element in a sorted list.

**Prompt:** #Generate a python code to create a function binary\_search(arr, target) returning the index of the target or -1 if not found. Use docstring to explain best, average and worst case time complexity, use pydoc to generate documentation

## Code:

```
65  #Generate a python code to create a function binary_search(arr, target) returning the index of the target or -1 if not found. Use docstring to explain best, average and worst case time complexity, use pydoc to generate documentation
66  def binary_search(arr, target):
67
68      This function implements the binary search algorithm to find the index of a target element in a sorted list.
69
70      Binary search works by repeatedly dividing the search interval in half. If the target value is less than the middle element,
71      the search continues in the left half; if it is greater, the search continues in the right half. This process continues until
72      the target value is found or the search interval is empty.
73
74      Parameters:
75      arr (list): A sorted list of elements to be searched.
76      target: The element to be searched for in the list.
77
78      Returns:
79      int: The index of the target element if found, or -1 if not found.
80
81      Time Complexity:
82      - Best Case: O(1) - when the target element is at the middle of the list.
83      - Average Case: O(log n) - where n is the number of elements in the list, due to halving the search space with each iteration.
84      - Worst Case: O(log n) - when the target element is not present in the list or is located at one of the ends.
85
86      Example:
87      >>> binary_search([1, 2, 3, 4, 5], 3)
88      2
89      >>> binary_search([1, 2, 3, 4, 5], 6)
90      -1
91      >>> binary_search([], 1)
92      -1
93      >>> binary_search([1], 1)
94      0
95      ...
96
97      left, right = 0, len(arr) - 1
98
99      while left <= right:
100          mid = left + (right - left) // 2 # calculate the middle index
101
102          if arr[mid] == target:
103              return mid # return the index if target is found
104          elif target < arr[mid]: # if target is smaller than mid, ignore left half
105              right = mid - 1 # Move left pointer to mid + 1
106          elif arr[mid] < target: # if target is larger than mid, ignore right half
107              left = mid + 1 # Move left pointer to mid + 1
108          else:
109              right = mid - 1 # Move right pointer to mid - 1
110
111
112      return -1 # return -1 if target is not found in the list
113  print("Index of target 3:", binary_search([1, 2, 3, 4, 5], 3)) # Example usage of the binary_search function to find the index of target 3
114  print("Index of target 6:", binary_search([1, 2, 3, 4, 5], 6)) # Example usage of the binary search function to find the index of target 6
115  print("Index of target 1 in empty list:", binary_search([], 1)) # Example usage of the binary_search function to find the index of target 1 in an empty list
116  print("Index of target 1 in single element list:", binary_search([1], 1)) # Example usage of the binary_search function to find the index of target 1 in a single element list
117
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```

## OutPut:

```
Index of target 3: 2
Index of target 6: -1
Index of target 1 in empty list: -1
Index of target 1 in single element list: 0
```

**Explanation:** The code snippet defines a function to calculate the factorial of a non-negative integer. It uses a loop to multiply the result by each integer from 1 to n, and includes a docstring that describes its functionality, parameters, return value, and provides examples of usage.

## Task Description #3: Smart Healthcare Appointment Scheduling System

**Prompt:** #Generate a python code to implement Smart Healthcare Appointment Scheduling System. Give suitable searching and sorting algorithms to optimize the scheduling process. Use docstring to explain the functionality of each function, use pydoc to generate documentation

# 1. Search appointments using appointment ID.

# 2. Sort appointments based on time or consultation fee.

### Code:

```

22  # Generate a python code to implement smart healthcare Appointment scheduling system. Give suitable searching and sorting algorithms to optimize the scheduling process. use docstring to explain the functionality of each function, use pydoc to generate documentation
23  #
24  # 1. Search appointments using appointment ID.
25  # 2. Sort appointments based on time or consultation fee.
26
27  class Appointment:
28
29      """This class represents an appointment in the Smart Healthcare Appointment Scheduling system.
30
31      Attributes:
32          appointment_id (int): Unique identifier for the appointment.
33          patient_name (str): Name of the patient.
34          doctor_name (str): Name of the doctor.
35          time (str): Time of the appointment in HH:MM format.
36          consultation_fee (float): Consultation fee for the appointment.
37
38      Methods:
39          def __init__(self, time, description):
40              self.time = time
41              self.description = description
42              self.appointment_id = appointment_id
43
44          def __lt__(self, other):
45              return self.time < other.time
46
47  class AppointmentScheduler:
48
49      """This class implements the Smart Healthcare Appointment Scheduling System.
50
51      It provides functionalities to add appointments, search for appointments by ID, and sort appointments based on time or consultation fee.
52
53      Methods:
54          def __init__(self):
55              self.appointments = [] # Initialize an empty list to store appointments
56
57          def add_appointment(self, appointment):
58              """Adds a new appointment to the scheduler.
59
60              Parameters:
61                  appointment (Appointment): The appointment object to be added to the scheduler.
62
63              self.appointments.append(appointment) # Add the appointment to the list of appointments
64
65          def search_appointment_by_id(self, appointment_id):
66              """Searches for an appointment by its ID using linear search.
67
68              Parameters:
69                  appointment_id (int): The unique identifier of the appointment to be searched.
69
70              Returns:
71                  Appointment: The appointment object if found, or None if not found.
72
73              for appointment in self.appointments: # Iterate through the list of appointments
74                  if appointment.appointment_id == appointment_id: # Check if the current appointment's ID matches the target ID
75                      return appointment # Return the appointment if found
76
77              return None # Return None if no matching appointment is found
78
79
80          def sort_appointments_by_time(self):
81              """Sorts the appointments based on time using merge sort algorithm."""
82              self.appointments = merge_sort(self.appointments) # Sort the appointments using merge sort based on time attribute
83
84          def sort_appointments_by_fee(self):
85              """Sorts the appointments based on consultation fee using merge sort algorithm."""
86              self.appointments = sorted(self.appointments, key=lambda x: x.consultation_fee) # Sort the appointments based on consultation fee using built-in sorted function with a lambda key
87
88      # Example usage of the AppointmentScheduler class
89      scheduler = AppointmentScheduler() # Create an instance of the AppointmentScheduler class
90      scheduler.add_appointment(appointment(1, "Jane Doe", "Dr. Smith", "10:00", 100.0)) # Add an appointment to the scheduler
91      scheduler.add_appointment(appointment(2, "Jane Doe", "Dr. Brown", "11:00", 150.0)) # Add another appointment to the scheduler
92      scheduler.add_appointment(appointment(3, "Alice", "Dr. Smith", "09:30", 120.0)) # Add another appointment to the scheduler
93      appointment = scheduler.search_appointment_by_id(2) # Search for an appointment by ID
94
95      if appointment:
96          print(f"Appointment found: {appointment.patient_name} with {appointment.doctor_name} at {appointment.time} for ${appointment.consultation_fee}") # Print the details of the found appointment
97      else:
98          print("Appointment not found.") # Print a message if the appointment is not found
99      scheduler.sort_appointments_by_time() # Sort the appointments by time
100
101      print("Appointments sorted by time: ") # Print a message indicating that the appointments are sorted by time
102      for appointment in scheduler.appointments: # Iterate through the sorted appointments
103          print(f"{appointment.patient_name} with {appointment.doctor_name} at {appointment.time} for ${appointment.consultation_fee}") # Print the details of each appointment sorted by time
104
105      scheduler.sort_appointments_by_fee() # Sort the appointments by consultation fee
106
107      print("Appointments sorted by consultation fee: ") # Print a message indicating that the appointments are sorted by consultation fee
108      for appointment in scheduler.appointments: # Iterate through the sorted appointments
109          print(f"{appointment.patient_name} with {appointment.doctor_name} at {appointment.time} for ${appointment.consultation_fee}") # Print the details of each appointment sorted by consultation fee
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```

**OutPut:**

```
Appointment found: Jane Doe with Dr. Brown at 11:00 for a fee of 150.0
```

**Explanation:** The code snippet implements a Smart Healthcare Appointment Scheduling System. It defines an Appointment class to represent individual appointments and a scheduling system class to manage the appointments. The system allows adding appointments, searching for appointments by ID, and sorting appointments by time or consultation fee. Each function is documented with a docstring explaining its purpose, parameters, return value, and examples of usage.

**Task Description #4: Railway Ticket Reservation System**

**Prompt:** #Generate a python code to implement Railway Ticket Reservation System.Identify suitable algorithms for searching and sorting to optimize the reservation process. Use docstring to explain the functionality of each function, use pydoc to generate documentation

- # 1. Search tickets using ticket ID.
- # 2. Sort bookings based on travel date or seat number.

## Code:

```
211 # Generate a python code to implement Railway Ticket Reservation System.Identify suitable algorithms for searching and sorting to optimize the reservation process. Use docstring to explain the functionality of each function, use pydoc to generate documentation
212 # 1. Search tickets using ticket ID.
213 # 2. Sort bookings based on travel date or seat number.
214
215 class Ticket:
216     """
217         This class represents a ticket in the Railway Ticket Reservation System.
218
219         Attributes:
220             ticket_id (int): Unique identifier for the ticket.
221             passenger_name (str): Name of the passenger.
222             train_number (str): Number of the train.
223             travel_date (str): Date of travel in YYYY-MM-DD format.
224             seat_number (str): Seat number assigned to the passenger.
225         ...
226     """
227     def __init__(self, ticket_id, passenger_name, train_number, travel_date, seat_number):
228         self.ticket_id = ticket_id
229         self.passenger_name = passenger_name
230         self.train_number = train_number
231         self.travel_date = travel_date
232         self.seat_number = seat_number
233
234 class TicketReservationSystem:
235     """
236         This class implements the Railway Ticket Reservation System.
237
238         It provides functionalities to add tickets, search for tickets by ID, and sort bookings based on travel date or seat number.
239         ...
240     """
241     def __init__(self):
242         self.tickets = [] # Initialize an empty list to store tickets
243
244     def add_ticket(self, ticket):
245         """
246             Adds a new ticket to the reservation system.
247
248             Parameters:
249                 ticket (Ticket): The ticket object to be added to the reservation system.
250             ...
251             self.tickets.append(ticket) # Add the ticket to the list of tickets
252
253     def search_ticket_by_id(self, ticket_id):
254         """
255             Searches for a ticket by its ID using linear search.
256
257             Parameters:
258                 ticket_id (int): The unique identifier of the ticket to be searched.
259             ...
260             Returns:
261                 Ticket: The ticket object if found, or None if not found.
262             ...
263             for ticket in self.tickets: # Iterate through the list of tickets
264                 if ticket.ticket_id == ticket_id: # Check if the current ticket's ID matches the target ID
265                     return ticket # Return the ticket if found
266             return None # Return None if no matching ticket is found
267
268     def sort_tickets_by_travel_date(self):
269         """
270             Sorts the tickets based on travel date using merge sort algorithm.***
271             self.tickets = merge_sort(self.tickets) # Sort the tickets using merge sort based on travel date attribute
272
273     def sort_tickets_by_seat_number(self):
274         """
275             Sorts the tickets based on seat number using merge sort algorithm.***
276             self.tickets = sorted(self.tickets, key=lambda x: x.seat_number) # Sort the tickets based on seat number using built-in sorted function with a lambda key
277
278 # Example Usage of the TicketReservationSystem class
279 reservation_system = TicketReservationSystem() # Create an instance of the TicketReservationSystem class
280 reservation_system.add_ticket(Ticket(1, "John Doe", "12345", "2024-07-01", "A1")) # Add a ticket to the reservation system
281 reservation_system.add_ticket(Ticket(2, "Jane Doe", "12345", "2024-07-01", "A2")) # Add another ticket to the reservation system
282 reservation_system.add_ticket(Ticket(3, "Alice", "54321", "2024-07-02", "B1")) # Add another ticket to the reservation system
283 ticket = reservation_system.search_ticket_by_id(2) # Search for a ticket by ID
284 if ticket:
285     print(f"Ticket found: {ticket.passenger_name} on train {ticket.train_number} for travel date {ticket.travel_date} at seat {ticket.seat_number}") # Print the details of the found ticket
286 else:
287     print("Ticket not found.") # Print a message if the ticket is not found
288 reservation_system.sort_tickets_by_travel_date() # Sort the tickets by travel date
289 print("Tickets sorted by travel date:") # Print a message indicating that the tickets are sorted by travel date
290 for ticket in reservation_system.tickets: # Iterate through the sorted tickets
291     print(f"({ticket.passenger_name}) on train {ticket.train_number} for travel date {ticket.travel_date} at seat {ticket.seat_number}") # Print the details of each ticket sorted by travel date
292 reservation_system.sort_tickets_by_seat_number() # Sort the tickets by seat number
293 print("Tickets sorted by seat number:") # Print a message indicating that the tickets are sorted by seat number
294 for ticket in reservation_system.tickets: # Iterate through the sorted tickets
295     print(f"({ticket.passenger_name}) on train {ticket.train_number} for travel date {ticket.travel_date} at seat {ticket.seat_number}") # Print the details of each ticket sorted by seat number
296
297
298
299
```

## OutPut:

```
Ticket found: Jane Doe on train 12345 for travel date 2024-07-01 at seat A2
```

**Explanation:** The code snippet implements a Railway Ticket Reservation System. It defines a Ticket class to represent individual tickets and a reservation system class to manage the tickets. The system allows adding tickets, searching for tickets by ID, and sorting tickets by travel date or seat number. Each function is documented with a docstring explaining its purpose, parameters, return value, and examples of usage.

## Task Description #5: Smart Hostel Room Allocation System

**Prompt:** #Generate a python code to implement Smart Hostel Room Allocation System. Identify suitable algorithms for searching and sorting to optimize the allocation process. Use docstring to explain the functionality of each function, use pydoc to generate documentation

# 1. Search allocation details using student ID.

# 2. Sort records based on room number or allocation date.

## Code:

```

294     """
295     Generates a python code to implement Smart Hostel Room Allocation System. Identify suitable algorithms for searching and sorting to optimize the allocation process. Use docstring to explain the functionality of each function, use pydoc to generate documentation
296     # 1. Search allocation details using student ID.
297     # 2. Sort records based on room number or allocation date.
298     class RoomAllocation:
299         """
300             This class represents a room allocation in the Smart Hostel Room Allocation System.
301
302             Attributes:
303                 allocation_id (int): Unique identifier for the room allocation.
304                 student_name (str): Name of the student.
305                 student_id (str): ID of the student.
306                 room_number (str): Number of the allocated room.
307                 allocation_date (str): Date of allocation in YYYY-MM-DD format.
308
309             def __init__(self, allocation_id, student_name, student_id, room_number, allocation_date):
310                 self.allocation_id = allocation_id
311                 self.student_name = student_name
312                 self.student_id = student_id
313                 self.room_number = room_number
314                 self.allocation_date = allocation_date
315
316         class HostelRoomAllocationSystem:
317             """
318                 This class implements the Smart Hostel Room Allocation System.
319
320                 It provides functionalities to add room allocations, search for allocation details by student ID, and sort records based on room number or allocation date.
321
322             def __init__(self):
323                 self.allocations = [] # Initialize an empty list to store room allocations
324
325             def add_allocation(self, allocation):
326                 """
327                     Adds a new room allocation to the system.
328
329                     Parameters:
330                         allocation (RoomAllocation): The room allocation object to be added to the system.
331
332                     self.allocations.append(allocation) # Add the room allocation to the list of allocations
333
334             def search_allocation_by_student_id(self, student_id):
335                 """
336                     Searches for room allocation details by student ID using linear search.
337
338                     Parameters:
339                         student_id (str): The ID of the student whose allocation details are to be searched.
340
341                     Returns:
342                         RoomAllocation: The room allocation object if found, or None if not found.
343
344                     for allocation in self.allocations: # Iterate through the list of allocations
345                         if allocation.student_id == student_id: # Check if the current allocation's student ID matches the target ID
346                             return allocation # Return the allocation if found
347
348                     return None # Return None if no matching allocation is found
349
350             def sort_allocations_by_room_number(self):
351                 """
352                     Sorts the room allocations based on room number using merge sort algorithm.
353                     self.allocations = merge_sort(self.allocations) # Sort the allocations using merge sort based on room number attribute
354
355             def sort_allocations_by_date(self):
356                 """
357                     Sorts the room allocations based on allocation date using merge sort algorithm.
358                     self.allocations = sorted(self.allocations, key=lambda x: x.allocation_date) # Sort the allocations based on allocation date using built-in sorted function with a lambda key
359
360         # Example usage of the HostelRoomAllocationSystem class
361         allocation_system = HostelRoomAllocationSystem() # Create an instance of the HostelRoomAllocationSystem class
362         allocation_system.add_allocation(RoomAllocation(1, "John Doe", "S123", "101", "2024-07-01")) # Add a room allocation to the system
363         allocation_system.add_allocation(RoomAllocation(2, "Jane Doe", "S124", "102", "2024-07-02")) # Add another room allocation to the system
364         allocation_system.add_allocation(RoomAllocation(3, "Alice", "S125", "101", "2024-07-03")) # Add another room allocation to the system
365         allocation = allocation_system.search_allocation_by_student_id("S124") # Search for room allocation details by student ID
366
367         if allocation:
368             print(f"Allocation found: {allocation.student_name} in room {allocation.room_number} allocated on {allocation.allocation_date}") # Print the details of the found allocation
369         else:
370             print("Allocation not found.") # Print a message if the allocation is not found
371
372         allocation_system.sort_allocations_by_room_number() # Sort the room allocations by room number
373         print("Room allocations sorted by room number:") # Print a message indicating that the room allocations are sorted by room number
374
375         for allocation in allocation_system.allocations: # Iterate through the sorted allocations
376             print(f"{allocation.student_name} in room {allocation.room_number} allocated on {allocation.allocation_date}") # Print the details of each allocation sorted by room number
377
378         allocation_system.sort_allocations_by_date() # Sort the room allocations by allocation date
379         print("Room allocations sorted by allocation date:") # Print a message indicating that the room allocations are sorted by allocation date
380
381         for allocation in allocation_system.allocations: # Iterate through the sorted allocations
382             print(f"{allocation.student_name} in room {allocation.room_number} allocated on {allocation.allocation_date}") # Print the details of each allocation sorted by allocation date
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```

## OutPut:

```
Allocation found: Jane Doe in room 102 allocated on 2024-07-02
```

**Explanation:** The code snippet implements a Smart Hostel Room Allocation System. It defines a RoomAllocation class to represent individual room allocations and a hostel room allocation system class to manage the allocations. The system allows adding room allocations, searching for allocation details by student ID, and sorting records by room number or allocation date. Each function is documented with a docstring explaining its purpose, parameters, return value, and examples of usage.

## **Task Description #6: Online Movie Streaming Platform**

### **Prompt:**

#Generate a python code to implement Online Movie Streaming Platform. Identify suitable algorithms for searching and sorting to optimize the streaming process. Use docstring to explain the functionality of each function, use pydoc to generate documentation

# 1. Search movies by movie ID.

# 2. Sort movies based on rating or release year.

### **Code:**

```

381 #Generate a python code to implement Online Movie Streaming Platform. Identify suitable algorithms for searching and sorting to optimize the streaming process. Use docstring to explain the functionality of each function, use pydoc to generate documentation
382 # i. Search movies by movie ID.
383 # ii. Sort movies based on rating or release year.
384 class Movie:
385     """
386         This class represents a movie in the Online Movie Streaming Platform.
387
388     Attributes:
389         movie_id (int): Unique identifier for the movie.
390         title (str): Title of the movie.
391         director (str): Director of the movie.
392         release_year (int): Year the movie was released.
393         rating (float): Rating of the movie on a scale of 1 to 10.
394
395     def __init__(self, movie_id, title, director, release_year, rating):
396         self.movie_id = movie_id
397         self.title = title
398         self.director = director
399         self.release_year = release_year
400         self.rating = rating
401
402 class MovieStreamingPlatform:
403     """
404         This class implements the Online Movie Streaming Platform.
405
406     It provides functionalities to add movies, search for movies by ID, and sort movies based on rating or release year.
407
408     def __init__(self):
409         self.movies = [] # Initialize an empty list to store movies
410
411     def add_movie(self, movie):
412         """
413             Adds a new movie to the streaming platform.
414
415             Parameters:
416                 movie (Movie): The movie object to be added to the streaming platform.
417
418             self.movies.append(movie) # Add the movie to the list of movies
419
420     def search_movie_by_id(self, movie_id):
421         """
422             Searches for a movie by its ID using linear search.
423
424             Parameters:
425                 movie_id (int): The unique identifier of the movie to be searched.
426
427             Returns:
428                 Movie: The movie object if found, or None if not found.
429
430             for movie in self.movies: # Iterate through the list of movies
431                 if movie.movie_id == movie_id: # Check if the current movie's ID matches the target
432                     return movie # Return the movie if found
433
434             return None # Return None if no matching movie is found
435
436
437     def sort_movies_by_rating(self):
438         """
439             Sorts the movies based on rating using merge sort algorithm.
440             self.movies = merge_sort(self.movies) # Sort the movies using merge sort based on rating attribute
441
442
443     def sort_movies_by_release_year(self):
444         """
445             Sorts the movies based on release year using merge sort algorithm.
446             self.movies = sorted(self.movies, key=lambda x: x.release_year) # Sort the movies based on release year using built-in sorted function with a lambda key
447
448     # Example usage of the MovieStreamingPlatform class
449     streaming_platform = MovieStreamingPlatform() # Create an instance of the MovieStreamingPlatform class
450     streaming_platform.add_movie(Movie(1, "Inception", "Christopher Nolan", 2010, 8.8)) # Add a movie to the streaming platform
451     streaming_platform.add_movie(Movie(2, "The Matrix", "Lana Wachowski, Lilly Wachowski", 1999, 8.7)) # Add another movie to the streaming platform
452     streaming_platform.add_movie(Movie(3, "Interstellar", "Christopher Nolan", 2014, 8.6)) # Add another movie to the streaming platform
453
454     movie = streaming_platform.search_movie_by_id(2) # Search for a movie by ID
455
456     if movie:
457         print(f"Movie found: {movie.title} directed by {movie.director} released in {movie.release_year} with rating {movie.rating}") # Print the details of the found movie
458     else:
459         print("Movie not found.") # Print a message if the movie is not found
460
461     streaming_platform.sort_movies_by_rating() # Sort the movies by rating
462     print("Movies sorted by rating:") # Print a message indicating that the movies are sorted by rating
463     for movie in streaming_platform.movies: # Iterate through the sorted movies
464         print(f"({movie.title}) directed by {movie.director} released in {movie.release_year} with rating {movie.rating}") # Print the details of each movie sorted by rating
465
466     streaming_platform.sort_movies_by_release_year() # Sort the movies by release year
467     print("Movies sorted by release year:") # Print a message indicating that the movies are sorted by release year
468     for movie in streaming_platform.movies: # Iterate through the sorted movies
469         print(f"({movie.title}) directed by {movie.director} released in {movie.release_year} with rating {movie.rating}") # Print the details of each movie sorted by release year
470
471
472
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480
481

```

## OutPut:

```
Movie found: The Matrix directed by Lana Wachowski, Lilly Wachowski released in 1999 with rating 8.7
```

**Explanation:** The code snippet implements an Online Movie Streaming Platform. It defines a Movie class to represent individual movies and a streaming platform class to manage the movies. The system allows adding movies, searching for movies by ID, and sorting movies by rating or release year. Each function is documented with a docstring explaining its purpose, parameters, return value, and examples of usage.

## Task Description #7: Smart Agriculture Crop Monitoring System

**Prompt:** #Generate a python code to implement Smart Agriculture Crop Monitoring System. Identify suitable algorithms for searching and sorting to optimize the monitoring process. Use docstring to explain the functionality of each function, use pydoc to generate documentation

# 1. Search crop details using crop ID.

# 2. Sort crops based on moisture level or yield estimate.

### Code:

```
465 # Generate a python code to implement Smart Agriculture Crop Monitoring System. Identify suitable algorithms for searching and sorting to optimize the monitoring process. Use docstring to explain the functionality of each function, use pydoc to generate documentation
466 # 1. Search crop details using crop ID.
467 # 2. Sort crops based on moisture level or yield estimate.
468
469 class Crop:
470
471     """This class represents a crop in the Smart Agriculture Crop Monitoring System.
472
473     Attributes:
474         crop_id (int): Unique identifier for the crop.
475         crop_name (str): Name of the crop.
476         moisture_level (float): Current moisture level of the crop in percentage.
477         yield_estimate (float): Estimated yield of the crop in tons per hectare.
478
479     """
480     def __init__(self, crop_id, crop_name, moisture_level, yield_estimate):
481         self.crop_id = crop_id
482         self.crop_name = crop_name
483         self.moisture_level = moisture_level
484         self.yield_estimate = yield_estimate
485
486 class CropMonitoringSystem:
487
488     """This class implements the smart Agriculture Crop Monitoring system.
489
490     It provides functionalities to add crops, search for crop details by crop id, and sort crops based on moisture level or yield estimate.
491
492     """
493     def __init__(self):
494         self.crops = [] # Initialize an empty list to store crops
495
496     def add_crop(self, crop):
497         """Adds a new crop to the monitoring system.
498
499         Parameters:
500             crop (Crop): The crop object to be added to the monitoring system.
501
502         Returns:
503             None: Adds the crop to the list of crops
504
505     def search_crop_by_id(self, crop_id):
506         """Searches for crop details by crop ID using linear search.
507
508         Parameters:
509             crop_id (int): The unique identifier of the crop to be searched.
510
511         Returns:
512             Crop: The crop object if found, or None if not found.
513
514         for crop in self.crops: # Iterate through the list of crops
515             if crop.crop_id == crop_id: # Check if the current crop's ID matches the target ID
516                 return crop # Return the crop if found
517
518         return None # Return None if no matching crop is found
519
520     def sort_crops_by_moisture_level(self):
521         """Sorts the crops based on moisture level using merge sort algorithm."""
522         self.crops = merge_sort(self.crops) # Sort the crops using merge sort based on moisture level attribute
523
524     def sort_crops_by_yield_estimate(self):
525         """Sorts the crops based on yield estimate using merge sort algorithm."""
526         self.crops = sorted(self.crops, key=lambda x: x.yield_estimate) # Sort the crops based on yield estimate using built-in sorted function with a lambda key
527
528 # Example usage of the CropMonitoringSystem class
529 monitoring_system = CropMonitoringSystem() # Create an instance of the CropMonitoringSystem class
530 monitoring_system.add_crop(Crop(1, "Wheat", 30.5, 3.2)) # Add a crop to the monitoring system
531 monitoring_system.add_crop(Crop(2, "Corn", 25.0, 4.5)) # Add another crop to the monitoring system
532 monitoring_system.add_crop(Crop(3, "Rice", 40.0, 5.0)) # Add another crop to the monitoring system
533 crop = monitoring_system.search_crop_by_id(2) # Search for crop details by crop ID
534
535 if crop:
536     print(f"\nCrop found: {crop.crop_name} with moisture level {crop.moisture_level}% and yield estimate {crop.yield_estimate} tons/ha") # Print the details of the found crop
537 else:
538     print("Crop not found.") # Print a message if the crop is not found
539
540 monitoring_system.sort_crops_by_moisture_level() # Sort the crops by moisture level
541 print("Crops sorted by moisture level!") # Print a message indicating that the crops are sorted by moisture level
542 for crop in monitoring_system.crops: # Iterate through the sorted crops
543     print(f"\n{crop.crop_name} with moisture level {crop.moisture_level}% and yield estimate {crop.yield_estimate} tons/ha") # Print the details of each crop sorted by moisture level
544
545 monitoring_system.sort_crops_by_yield_estimate() # Sort the crops by yield estimate
546 print("Crops sorted by yield estimate!") # Print a message indicating that the crops are sorted by yield estimate
547 for crop in monitoring_system.crops: # Iterate through the sorted crops
548     print(f"\n{crop.crop_name} with moisture level {crop.moisture_level}% and yield estimate {crop.yield_estimate} tons/ha") # Print the details of each crop sorted by yield estimate
549
550
551
552
553
554
```

## **OutPut:**

```
Crop found: Corn with moisture level 25.0% and yield estimate 4.5 tons/ha
```

**Explanation:** The code snippet implements a Smart Agriculture Crop Monitoring System. It defines a Crop class to represent individual crops and a crop monitoring system class to manage the crops. The system allows adding crops, searching for crop details by crop ID, and sorting crops by moisture level or yield estimate. Each function is documented with a docstring explaining its purpose, parameters, return value, and examples of usage.

## **Task Description #8: Airport Flight Management System**

**Prompt:** #Generate a python code to implement Airport Flight Management System. Identify suitable algorithms for searching and sorting to optimize the management process. Use docstring to explain the functionality of each function, use pydoc to generate documentation

- # 1. Search flight details using flight ID.
- # 2. Sort flights based on departure time or destination.

## Code:

```

549 #Generate a python code to implement Airport Flight Management System. Identify suitable algorithms for searching and sorting to optimize the management process. Use docstring to explain the functionality of each function, use pydoc to generate documentation
550
551 # 1. Search flight details using flight ID.
552 # 2. Sort flights based on departure time or destination.
553 class Flight:
554     """
555         This class represents a flight in the Airport Flight Management System.
556
557     Attributes:
558         flight_id (int): Unique identifier for the flight.
559         airline (str): Name of the airline operating the flight.
560         departure_time (str): Departure time of the flight in HH:MM format.
561         destination (str): Destination of the flight.
562     """
563
564     def __init__(self, flight_id, airline, departure_time, destination):
565         self.flight_id = flight_id
566         self.airline = airline
567         self.departure_time = departure_time
568         self.destination = destination
569
570 class FlightManagementSystem:
571     """
572         This class implements the Airport Flight Management System.
573
574     It provides functionalities to add flights, search for flight details by flight ID, and sort flights based on departure time or destination.
575     """
576     def __init__(self):
577         self.flights = [] # Initialize an empty list to store flights
578
579     def add_flight(self, flight):
580         """
581             Adds a new flight to the management system.
582
583             Parameters:
584                 flight (Flight): The flight object to be added to the management system.
585             """
586         self.flights.append(flight) # Add the flight to the list of flights
587
588     def search_flight_by_id(self, flight_id):
589         """
590             Searches for flight details by flight ID using linear search.
591
592             Parameters:
593                 flight_id (int): The unique identifier of the flight to be searched.
594
595             Returns:
596                 Flight: The flight object if found, or None if not found.
597
598             """
599         for flight in self.flights: # Iterate through the list of flights
600             if flight.flight_id == flight_id: # Check if the current flight's ID matches the target ID
601                 return flight # Return the flight if found
602         return None # Return None if no matching flight is found
603
604
605     def sort_flights_by_departure_time(self):
606         """
607             Sorts the flights based on departure time using merge sort algorithm.
608             """
609         self.flights = merge_sort(self.flights) # Sort the flights using merge sort based on departure time attribute
610
611     def sort_flights_by_destination(self):
612         """
613             Sorts the flights based on destination using merge sort algorithm.
614             """
615         self.flights = sorted(self.flights, key=lambda x: x.destination) # Sort the flights based on destination using built-in sorted function with a lambda key
616
617     # Example usage of the FlightManagementSystem class
618     management_system = FlightManagementSystem() # Create an instance of the FlightManagementSystem class
619     management_system.add_flight(Flight(1, "Airline A", "10:00", "New York")) # Add a flight to the management system
620     management_system.add_flight(Flight(2, "Airline B", "12:00", "Los Angeles")) # Add another flight to the management system
621     management_system.add_flight(Flight(3, "Airline C", "09:00", "Chicago")) # Add another flight to the management system
622
623     flight = management_system.search_flight_by_id(2) # Search for flight details by flight ID
624     if flight:
625         print("Flight found: {} departing at {} to {}".format(flight.airline, flight.departure_time, flight.destination)) # Print the details of the found flight
626     else:
627         print("Flight not found.") # Print a message if the flight is not found
628
629     management_system.sort_flights_by_departure_time() # Sort the flights by departure time
630     print("Flights sorted by departure time: ") # Print a message indicating that the flights are sorted by departure time
631     for flight in management_system.flights: # Iterate through the sorted flights
632         print("{} departing at {} to {}".format(flight.airline, flight.departure_time, flight.destination)) # Print the details of each flight sorted by departure time
633
634     management_system.sort_flights_by_destination() # Sort the flights by destination
635     print("Flights sorted by destination: ") # Print a message indicating that the flights are sorted by destination
636     for flight in management_system.flights: # Iterate through the sorted flights
637         print("{} departing at {} to {}".format(flight.airline, flight.departure_time, flight.destination)) # Print the details of each flight sorted by destination

```

## OutPut:

Flight found: Airline B departing at 12:00 to Los Angeles

**Explanation:** The code snippet implements an Airport Flight Management System. It defines a `Flight` class to represent individual flights and a `FlightManagementSystem` class to manage the flights. The system allows adding flights, searching for flight details by flight ID, and sorting flights by departure time or destination. Each function is documented with a docstring explaining its purpose, parameters, return value, and examples of usage.