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Expt No.3 - Merge Sort

```
In [11]:    1  import random
            2  import time
            3  import matplotlib.pyplot as plt
            4
            5  arr = input("Enter the list of elements separated by space:").split()
            6  arr = [int(x) for x in arr]
            7  print("Input array:",arr)
            8
            9  def merge_sort(arr):
           10      if len(arr) <= 1:
           11          return arr
           12
           13      mid = len(arr) // 2
           14      left = merge_sort(arr[ :mid])
           15      right = merge_sort(arr[mid: ])
           16      return merge(left, right)
           17
           18  def merge(left, right):
           19      result = []
           20      i = j = 0
           21
           22      while i < len(left)and j < len(right):
           23          if left[i] < right [j]:
           24              result. append(left[i])
           25              i = i+1
           26
           27          else:
           28              result.append(right[j])
           29              j = j+1
           30
           31      result.extend(left[i:])
           32      result.extend(right[j:])
           33      return result
           34
           35  sorted_arr = merge_sort(arr)
           36  print("Sorted array: ", sorted_arr)
           37
           38  start_time = time. time()
           39  sorted_arr = merge_sort(arr)
           40  end_time = time. time()
           41
           42  print("Time taken to sort: ",end_time - start_time,"seconds")
```

```
Enter the list of elements separated by space:22 15 71 66 4 69
Input array: [22, 15, 71, 66, 4, 69]
Sorted array:  [4, 15, 22, 66, 69, 71]
Time taken to sort:  0.0 seconds
```

```
In [10]:    1  n_values = [5000, 6000, 7000, 8000]
            2  time_values = []
            3
            4  for n in n_values:
            5      arr = [random.randint(1,9) for _ in range(n)]
            6
            7
            8      start_time = time. time ()
            9      sorted_arr = merge_sort(arr)
           10      end_time = time.time()
           11
           12      time_taken = end_time - start_time
           13      print("Time taken to sort", n, "elements:", time_taken, "seconds")
           14      time_values.append(time_taken)
           15
           16  plt.plot(n_values, time_values,color = "green")
           17  plt.xlabel('Number of Elements (n) ')
           18  plt.ylabel('Time Taken (seconds)')
           19  plt.title('Merge Sort Time Complexity Analysis')
           20  plt.grid(True)
           21  plt.show()
```

Time taken to sort 5000 elements: 0.016068220138549805 seconds
Time taken to sort 6000 elements: 0.01634693145751953 seconds
Time taken to sort 7000 elements: 0.03231048583984375 seconds
Time taken to sort 8000 elements: 0.02610015869140625 seconds