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LAB_3.py LAB_5.py
LAB_3.py > ...
1 # part (a) -->
2 from timeit import *
3 x = ''
4 def binary_search(array, item):
5     beg, end = 0, len(array)-1
6     mid = int((beg+end)/2)
7
8     while beg <= end and array[mid] != item:
9         if item < array[mid]:
10             end = mid - 1
11             mid = int((beg+end)/2)
12         else:
13             beg = mid + 1
14             mid = int((beg+end)/2)
15         if array[mid] == item:
16             return mid
17         else:
18             return None
19 binary_search([1,2,3,4,5,6],2)
20 ...
21 print('The time for own implementation is: ',timeit(x))
22 print('The time for built-in implementation is: ', timeit('arr=[1,2,3,4,5,6]
23 arr.index(2)'))
```

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LAB_3.py LAB_5.py
LAB_3.py > ...
25 # part (c) -->
26 def check_sort(arr):
27     for i in range(len(arr)-1):
28         if arr[i] > arr[i+1]:
29             return False
30     return True
31
32 def take_array():
33     array_elements = input(f"Enter the numbers of the array separated by commas: ").split(',')
34     array_elements = list(map(lambda x: int(x), array_elements))
35     if check_sort(array_elements):
36         return array_elements
37     else:
38         return f'The inputed array is not sorted:('
39
40 def insertion_sort(arr):
41     for i in range(len(arr)-1):
42         if arr[i] < arr[i+1]:
43             continue
44         else:
45             temp = arr[i]
46             arr[i] = arr[i+1]
47             arr[i+1] = temp
48     return arr
```

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LAB_3.py LAB_5.py
LAB_3.py > ...
49
50 def binary_search():
51     arr = take_array()
52     if check_sort(arr):
53         item = int(input(f'enter the number which you want to search in the above array: '))
54         if isinstance(arr, list):
55             beg, end = 0, len(arr)-1
56             mid = (beg+end)//2
57             while beg <= end and arr[mid] != item:
58                 if item < arr[mid]:
59                     end = mid - 1
60                     mid = (beg+end)//2
61                 else:
62                     beg = mid + 1
63                     mid = (beg+end)//2
64             if item == arr[mid]:
65                 return mid
66             else:
67                 print(f'Your entered item is not in the array, adding that item in the array: ')
68                 arr.append(item)
69                 insertion_sort(arr)
70                 return arr
71         else:
72             message = f'The Inputed Array is not Sorted'
73             return message
74     else:
75         return f'The inputed array is not sorted!!'
76
77 print(binary_search())
```

```
LAB_5.py x
LAB_5.py > storeTriangular
1 # Algorithm A5.1
2 A = [[1,0,0],[2,3,0],[4,5,6]]
3 # here A is a lower triangular matrix of order 3 x 3.
4 def storeTriangular(array):
5     U = []
6     for i in range(len(A)):
7         for j in range(len(A)):
8             if j <= i:
9                 U.append(A[i][j])
10    return U
11 # print(storeTriangular(A))

12
13 from math import *
14 # Algorithm A5.2
15 U = [1,1,2,1,2,3]
16 def retrieveTriangular(U):
17     a = 1
18     b = 1
19     c = -2*len(U)
20     d = b**2-4*a*c
21     x1 = (-b+sqrt(d))/(2*a)
22     x2 = (-b-sqrt(d))/(2*a)
23     if x1.real > x2.real:
24         c = int(x1.real)
25     else:
26         c = int(x2.real)
27     A = []
28     count = 0
29     for i in range(c):
30         lst = []
31         for j in range(c):
32             if j <= i:
33                 lst.append(U[count])
34                 count += 1
35             else:
36                 lst.append(0)
37         A.append(lst)
38     return A
39 # print(retrieveTriangular(U))

40
41 # part c
42 # Algo to store the non-zero values of a Tridiagonal Matrix B in a linear array U.
43 def storeTriDiagonal(array):
44     U = []
45     for i in range(len(array)):
46         for j in range(len(array)):
47             # checking for the first row
48             if i == 0 and j in [0,1]:
49                 U.append(array[i][j])
50             # checking for the last row
51             elif i == len(array)-1 and j in [len(array)-1, len(array)-2]:
52                 U.append(array[i][j])
53             # for all the middle rows
54             else:
55                 if j >= i-1 and j <= i+1:
56                     U.append(array[i][j])
57     return U

58
59 # Algo to retrieve the non-zero values from a linear array U and place them in a tridiagonal matrix B
60 def retrieveTriDiagonal(U):
61     B = []
62     count = 0
63     # for n
64     n = int((len(U)+2)/3)
65     for i in range(n):
66         lst = []
67         for j in range(n):
68             if i == 0 and j in [0,1]:
69                 lst.append(U[count])
70                 count += 1
71             elif i == n-1 and j in [n-1, n-2]:
72                 lst.append(U[count])
73                 count += 1
74             elif j >= i-1 and j <= i+1:
75                 lst.append(U[count])
76                 count += 1
77             else:
78                 lst.append(0)
79         B.append(lst)
80     return B
81 U = [5, -7, 1, 4, 3, 9, -3, 6, 2, 4]
82 print(retrieveTriDiagonal(U))
```

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EXPLORER
LABS
LAB_2.pdf
LAB_3 and LAB_5...
LAB_3.py
LAB_4.py
LAB_5.py
LAB_5.py
97 from scipy.sparse import *
98 import numpy as np
99
100 mat = [
101     [1, 23, 0, 0, 0],
102     [1, 2, 8, 0, 0],
103     [0, 0, 20, 0, 0],
104 ]
105
106 dense_arr = np.array(mat)
107 crr = csr_matrix(dense_arr)
108 dense_arr2 = csr_matrix.todense(crr)
109
110 print(crr)
111 print(dense_arr2)
112 print(dense_arr)
```

```
File Edit Selection View Go Run Terminal Help linked_list.py - LINKED_LISTS - Visual Studio Code
EXPLORER
LINKED_LISTS
doubly_linked_list.py U
linked_list.py M
linked_list.py > insert_at
27 # method to insert a node at the given index of the Linked List
28 def insert_at(self, index, data):
29     if index < 0 or index >= self.get_length():
30         raise Exception("Linked List Index Out of Range")
31
32     # for inserting at the head
33     if index == 0:
34         self.insert_at_beginning(data)
35         return
36     elif index == self.get_length() - 1:
37         self.insert_at_end(data)
38         return
39     else:
40         count = 0
41         itr = self.head
42         while itr:
43             if count == index - 1:
44                 node = Node(data, itr.next)
45                 itr.next = node
46                 break
47             itr = itr.next
48             count += 1
```

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File Edit Selection View Go Run Terminal Help linked_list.py - LINKED_LISTS - Visual Studio Code
EXPLORER
LINKED_LISTS
doubly_linked_list.py U
linked_list.py M
linked_list.py > Node
1 # first creating the class Node which holds its data and pointer to the next node
2 class Node:
3     def __init__(self, data = None, next = None):
4         self.data = data
5         self.next = next
6 # now creating a class called LinkedList which will keep track of all the Nodes
7 class LinkedList:
8     def __init__(self):
9         self.head = None
10 # method to insert a node at the beginning of the Linked List
11 def insert_at_beginning(self, data):...
14
15 # method to insert a node at the end of the Linked List
16 def insert_at_end(self, data):...
26
27 # method to insert a node at the given index of the Linked List
28 def insert_at(self, index, data):...
46
47 # method to search for a node at the given index of the Linked List
48 def search_at(self, index):...
62
63 # method to delete a node from the LinkedList
64 def remove_at(self, index):...
80
81 # method to create a new LinkedList from a list of values
82 def insert_values(self, data_list):...
86
87 # method to calculate the length of the Linked List
88 def get_length(self):...
95
96 #method to traverse the linkedList.
97 def printll(self):...
```

```
65 # method to delete a node from the LinkedList
66 def remove_at(self, index):
67     if index < 0 or index >= self.get_length():
68         raise Exception("Linked List Index Out of Range")
69
70     # for deleting the very first node
71     if index == 0:
72         self.head = self.head.next
73
74     count = 0
75     itr = self.head
76     while itr:
77         if count == index - 1:
78             itr.next = itr.next.next
79             break
80         itr = itr.next
81         count += 1
```

```
49 # method to search for a node at the given index of the Linked List
50 def search_at(self, index):
51     if index < 0 or index >= self.get_length():
52         raise Exception("Linked List Index Out of Range")
53
54     if index == 0:
55         return self.head.data
56     else:
57         count = 0
58         itr = self.head
59         while itr:
60             if count == index:
61                 return itr.data
62             itr = itr.next
63             count += 1
64
```

EXPLORER

linked\_list.py M doubly\_linked\_list.py U X

LINKED\_LISTS

- doubly\_linked\_list.py U
- linked\_list.py M

```
1 class Node:
2     def __init__(self, data=None, next=None, prev=None):
3         self.data = data
4         self.next = next
5         self.prev = prev
6
7 class DoublyLinkedList:
8     def __init__(self):
9         self.head = None
10
11 > def print_forward(self): ...
12
13 > def print_backward(self): ...
14
15 > def get_last_node(self): ...
16
17 > def get_length(self): ...
18
19 > def insert_at_begining(self, data): ...
20
21 > def insert_at_end(self, data): ...
22
23 > def insert_at(self, index, data): ...
24
25 > def remove_at(self, index): ...
26
27 > def insert_values(self, data_list): ...
28
29
30 if __name__ == '__main__':
31     ll = DoublyLinkedList()
32     ll.insert_values(["banana","mango","grapes","orange"])
33     ll.print_forward()
```

```
72
73 ✓ def insert_at(self, index, data):
74 ✓     if index<0 or index>self.get_length():
75         raise Exception("Invalid Index")
76
77 ✓     if index==0:
78         self.insert_at_begining(data)
79         return
80
81     count = 0
82     itr = self.head
83     while itr:
84         if count == index - 1:
85             node = Node(data, itr.next, itr)
86             if node.next:
87                 node.next.prev = node
88                 itr.next = node
89             break
90
91     itr = itr.next
92     count += 1
93
94 > def remove_at(self, index): ...
114
115 > def insert_values(self, data list): ...
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