Week 8 PYQs

15 June 2024

16:16

Counting Inversions:

1. Quiz 2, Jan 24

Question Label: Short Answer Question

Let L be an integer list of length n. The number of **inversions** is the number of the different pairs (i, j) where:

- 0 <= i < j < n
- L[i] > L[j]

The total number of inversions for L = [1, 3, 5, 7, 9, 8, 6, 4, 2] is ___.

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count : Yes
Answers Type : Equal

Text Areas: PlainText

Possible Answers:



2. End Term, Jan 24

Question Label: Short Answer Question

In a list L , two elements L[i] and L[j] form a inversion if L[i] > L[j] and i < j . The total number of inversions for the list L = [3, 4, 8, 9, 7, 5, 1] is _.

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :



3. End Term, Sep 23

Question Label: Multiple Choice Question

In a list L, two elements L[i] and L[j] form a **significant inversion** if L[i] > 2 * L[j] and i < j . The total number of significant inversions for L = [1, 11, 6, 3, 5, 2] is__.

Options:

- a. 4
- b. 5
- c. 6
- d. 7

4. Quiz 2, Sep 23

Question Label: Short Answer Question

In a list L, two elements L[i] and L[j] form an **inversion** if L[i] > L[j] and i < j.

What is the number of inversion pairs for the list L = [1, 5, 4, 2, 6, 3]?

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count : Yes
Answers Type : Equal
Text Areas : PlainText
Possible Answers :



5. End Term, Sep 23

Question Label: Multiple Choice Question

Let's take a list of integers **L** = **[2, 20, 6, 3, 5]**. Which of the below are the all inversion pairs of the list **L**?

Options :

6406532324456. * (20, 2), (20, 6), (20, 3), (20, 5), (6, 3)

6406532324457. <a>(20, 6), (20, 3), (20, 5), (6, 3), (6, 5)

6406532324458. * (20, 6), (20, 3), (20, 5), (6, 3), (3, 5)

6406532324459.

4 (20, 2), (20, 3), (20, 5), (20, 6)

6. Quiz 2, May 23

Question Label: Short Answer Question

In a list $\[L\]$, two elements $\[L\]$ and $\[L\]$ form an inversion if $\[L\]$ if $\[L\]$ and i < j. Consider a list $\[L\]$ of length $\[n\]$ in which all elements are distinct. List $\[L\]$ has exactly 21 inversions. The minimum possible value of $\[n\]$ is ___.

Answer:

Closest Pair of Points:

1. Quiz 2, Jan 24

Question Label: Multiple Choice Question

Apply the divide and conquer strategy to find the **closest pair of points** in a set. After dividing the set into two halves and recursively finding the closest pairs in each half, what additional step is required?

Options:

6406532578263. * Combine the results directly

6406532578264. * Perform a linear search for the closest pair

6406532578265. ✓ Consider pairs that span both halves

6406532578266. * Sort the points by their distances

Recursion Trees:

1. Quiz 2, Jan 24

Consider the following recurrence relation for an algorithm:-

$$T(n) = 4T(n/2) + O(n)$$

Base Case:- T(1) = 1

The complexity of this algorithm is__.

Options:









2. Quiz 2, Sep 23

Question Label: Multiple Choice Question

Consider the following recurrences.

1.
$$T_1(n) = 3T_1(n/3) + O(n^2)$$

$$2.T_2(n) = 9T_2(n/3) + O(n)$$

Base Case:-
$$T_1(1) = T_2(1) = 1$$

Select the correct complexity for given recurrences.

Options:

$$T_1=O(n^2)$$
 and $T_2=O(n^2)$

$$T_1 = O(n \ log \ n)$$
 and $T_2 = O(n^2)$

$$T_1 = O(n \ log \ n)$$
 and $T_2 = O(n^2 \ log \ n)$

$$T_1 = O(n^2)$$
 and $T_2 = O(n \ log \ n)$

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3. Quiz 2, Sep 23

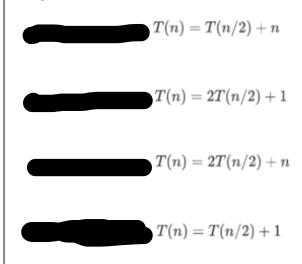
Question Label: Multiple Choice Question

Consider the following function to return the minimum element in the list L of size n.

```
def find_min(L, low, high):
    if low == high:
        return L[low]
    mid = (low + high) // 2
    min1 = find_min(L, low, mid)
    min2 = find_min(L, mid + 1, high)
    return min(min1, min2)
```

Which of the following represents the correct recurrence relation for the given function find_min?

Options:



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4. End Term, May 23

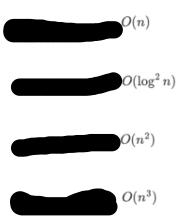
Consider the following recurrence relation for an algorithm:-

$$T(n)=2T(n/3)+O(n^2)$$

Base Case:-
$$T(1) = 1$$

The complexity of this algorithm is_.

Options:





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5. Quiz 2, May 23

Maximum subarray sum:- Given an array of integers, the goal is to find a contiguous subarray (i.e., a subarray with elements positioned adjacent to each other in the original array) that has the largest possible sum.

Consider the following implementation max_subarray_sum to find the maximum subarray sum in an array:

```
1 def max_crossing_sum(arr, low, mid, high):
       left_sum = float('-inf')
2
      curr_sum = 0
3
      for i in range(mid-1, low - 1, -1):
4
5
          curr_sum += arr[i]
6
          if curr_sum > left_sum:
              left_sum = curr_sum
8
     right_sum = float('-inf')
9
10
      curr_sum = 0
      for i in range(mid, high):
11
12
           curr_sum += arr[i]
13
          if curr_sum > right_sum:
14
               right_sum = curr_sum
15
       return left_sum + right_sum
16
17 # In First call low = 0, high = len(arr)
   def max_subarray_sum(arr, low, high):
18
       if high - low <= 1:
19
20
          return arr[low]
21
22
      mid = (low + high) // 2
23
24
       left_sum = max_subarray_sum(arr, low, mid)
       right_sum = max_subarray_sum(arr, mid, high)
25
26
       cross_sum = max_crossing_sum(arr, low, mid, high
27
28
       return max(left_sum, right_sum, cross_sum)
```

What is the worst-case time complexity of this algorithm when applied to an array of size n?

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Quick / Fast Select:

1. Quiz 2, Jan 24

Question Label: Multiple Select Question

Consider the following statements and choose the correct ones.

Options:



The worst case running time of Quick select algorithm to find the kth largest number is O(n)



The time taken to find the median in an unsorted list using the Median of Medians(MoM) algorithm is O(n)



The Quick select algorithm is an example of the divide-and-conquer approach.



Using the Fast Select (Quick Select using MoM for pivot selection) strategy, the worst-case running time will be $\dot{O}(n^2)$ to find the kth largest number.

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2. End Term, Jan 24

Question Label: Short Answer Question

Consider the following function MOM.

```
def MoM(L): # Median of medians
    if len(L) <= 5:
        L.sort()
        return(L[len(L)//2])

# Construct list of block medians

M = []

for i in range(0,len(L),5):

X = L[i:i+5]

x.sort()

M.append(x[len(X)//2])

return(MoM(M))</pre>
```

What median value will be returned by the given MoM function for the following list?

```
1 [6,7,8,10,11,10,15,13,14,17,2,3,4,3,5]
```

Response Type: Numeric

Evaluation Required For SA: Yes

Show Word Count: Yes

Answers Type : Equal Text Areas : PlainText

Possible Answers:

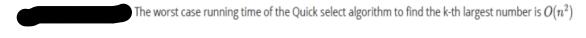


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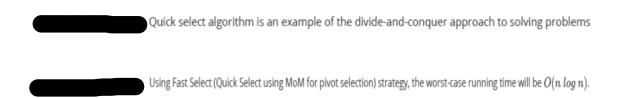
3. Quiz 2, Sep 23

Consider the following statements and choose the correct ones.

Options:



The time taken to find the median in an unsorted list using the Median of Medians (MoM) algorithm is O(n)



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4. End Term, Sep 23

Consider the following implementation for Median of Medians(MoM).

```
def MoM(L): # Median of medians

if len(L) <= 5:
    L.sort()
    return(L[len(L)//2])

# Construct list of block medians

M = []

for i in range(0,len(L),5):
    X = L[i:i+5]
    X.sort()
    M.append(X[len(X)//2])

return(MoM(M))</pre>
```

Let L = [8, 9, 5, 4, 1, 3, 6, 11,10, 19, 16, 6, 19, 18, 7, 20, 5, 76, 32, 2]. What is the returned value of MoM(L) using the list L?

Options:

```
6406532324452. * 18
6406532324453. * 19
6406532324454. √ 16
6406532324455. * 20
```

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