X

(https://swayam.gov.in) (https://swayam.gov.in/nc_details/NPTEL)

regentishamitha@gmail.com

NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Design and analysis of algorithms (course)

Course outline

How does an NPTEL online course work?

Week 1 : Introduction

Week 1 : Analysis of algorithms

Week 1 Quiz

Week 2 : Searching and sorting

Week 2 Quiz

- **Quiz: Week 2 Quiz (assessment?name=121)**

Week 2 Programming Assignment

Week 2 Quiz

The due date for submitting this assignment has passed.

Due on 2021-09-08, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2021-09-08, 22:53 IST

All questions carry equal weightage. You may submit as many times as you like within the deadline. Your final submission will be graded.

1) Consider the following variation of the merge function, where the input lists A and B are assumed to be sorted, with no duplicated elements, and C is the output list. ***2 points***

```
function StrangeMerge(A,m,B,n,C) {
  // A has m elements, B has n elements
  i = 0; j = 0; k = 0;

  while (i+j < m+n) {
    if (i == m) {C[k] = B[j]; j++; k++;}
    if (j == n) {C[k] = A[i]; i++; k++;}

    if (i < m and j < n) {
      if (A[i] < B[j]) {C[k] = A[i]; i++; k++;}
      if (A[i] == B[j]) {i++; j++;}
      if (A[i] > B[j]) {C[k] = B[j]; j++; k++;}

  }
}
```

What does `C` contain after executing `StrangeMerge(A,m,B,n,C)`?

Week 3 : Graphs

Week 3 Quiz

Week 3 Programming Assignment

Week 4 : Weighted graphs

Week 4 Quiz

Week 4 Programming Assignment

Week 5: Data Structures: Union-Find and Heaps

Week 5 : Divide and Conqure

Week 5 Quiz

Week 6: Data Structures: Search Trees

Week 6: Greedy Algorithms

Week 6 Quiz

Week 6 Programming Assignment

Week 7: Dynamic Programming

Week 7 Quiz

Week 7 Programming Assignment

○ C contains the intersection of A and B.

○ C contains all values in A that do not occur in B.

○ C contains all values in B that do not occur in A.

● C contains all values that occur in either A or B, but not in both input lists.

Yes, the answer is correct.
Score: 2

Feedback:
The merge skips any element that occurs in both A and B. So list C contains all elements that occur in A but not in B or vice versa, sometimes called the symmetric difference of A and B.

Accepted Answers:
C contains all values that occur in either A or B, but not in both input lists.

2) Suppose we modify mergesort as follows. We split the input into three equal segments, recursively sort each segment and then do a three way merge of the three sorted segments to obtain a fully sorted output. ***2 points***

If we work out the recurrence for this variant, we find that the worst case complexity is O(n $\log_3$ n), as opposed to O(n $\log_2$ n) for the usual divide and conquer that splits the input into two equal segments.

Let us call the new version 3-way mergesort. What can we say about the asymptotic worst case complexity of 3-way-mergesort with the usual mergesort?

● The asymptotic worst case complexity of 3-way mergesort is the same as that of usual mergesort.

○ The asymptotic worst case complexity of 3-way mergesort is better than that of usual mergesort.

○ The asymptotic worst case complexity of 3-way mergesort is worse than that of usual mergesort.

○ This depends on the length and the initial arrangement of values of the input.

Yes, the answer is correct.
Score: 2

Feedback:
A direct recursive analysis yields a complexity O(n $\log_3$ n). However, $\log_3$n is $\log_2$3 $\log_2$n, so the asymptotic complexity is the same as regular merge sort.

Accepted Answers:
The asymptotic worst case complexity of 3-way mergesort is the same as that of usual mergesort.

3) Suppose a new generation CPU can process 10^{10} operations per second. You have to sort an array with 10^8 elements. Which of the following is true? ***2 points***

○ Insertion sort will always take several hours while merge sort will always take less than 1 second.

○ Quicksort will always take several hours while merge sort will always take less than 1 second.

● Insertion sort could take several hours while merge sort will always take less than 1 second.

○ Insertion sort could take several hours while quicksort will always take less than 1 second.

Yes, the answer is correct.
Score: 2

Week 8: Linear Programming and Network Flows

Week 8: Intractability

Week 8 Quiz

Text Transcripts

Books

Download Videos

Feedback:
Mergesort has worst case complexity O(n log n), so all inputs will take less than 1 second. Both insertion sort and quicksort have worst case complexity O(n^2). However, this does not mean that all inputs will take time proportional to n^2.

Accepted Answers:
Insertion sort could take several hours while merge sort will always take less than 1 second.

4) Which of the following statements is ***not*** true about quicksort? ***2 points***

○ For every fixed strategy to choose a pivot for quicksort, we can construct a worst case input that requires time O(n^2).

○ If we could find the median in time O(n), quicksort would have worst case complexity O(n log n).

○ Quicksort and merge sort are both examples of divide and conquer algorithms.

● If we randomly choose a pivot element each time, quicksort will always terminate in time O(n log n).

Yes, the answer is correct.
Score: 2

Feedback:
Choosing a random pivot only provides an expected (not worst case) running time of O(n log n).

Accepted Answers:
If we randomly choose a pivot element each time, quicksort will always terminate in time O(n log n).

5) We have a list of three dimensional points [(7,8,1),(3,7,5),(6,4,1),(6,9,5),(0,5,2),(9,9,0)]. We sort these in ascending order by the third coordinate. Which of the folllowing corresponds to a stable sort of this input? ***2 points***

● [(9,9,0),(7,8,1),(6,4,1),(0,5,2),(3,7,5),(6,9,5)]

○ [(9,9,0),(7,8,1),(6,4,1),(0,5,2),(6,9,5),(3,7,5)]

○ [(0,5,2),(3,7,5),(6,4,1),(6,9,5),(7,8,1),(9,9,0)]

○ [(9,9,0),(6,4,1),(7,8,1),(0,5,2),(3,7,5),(6,9,5)]

Yes, the answer is correct.
Score: 2

Feedback:
Pairs with same third coordinate are (7,8,1) / (6,4,1) and (3,7,5) / (6,9,5). These must appear in the same order in the list sorted by third coordinate.

Accepted Answers:
[(9,9,0),(7,8,1),(6,4,1),(0,5,2),(3,7,5),(6,9,5)]