

COMP 251 Assignment 3 - Written

3)

Given an array of integers A, there can be 3 cases regarding implementing active lists with A[i]:

1. A[i] is the smallest, so we create a new list of length 1
2. A[i] is the largest, so we clone existing list and add A[i] to end
3. A[i] is in the middle, so we find the list with the largest end element that's smaller than A[i], clone and add A[i] to end and we discard lists with the same length as our new list

Note: Here, we have the end element of smaller lists always smaller than the end element of larger lists

//Pseudocode

longestIncrementalSubsequence(int[] s)

// Keep track of predecessors and ends of each subsequence

int[] preds = new int[s.length]

int[] ends = new int[s.length + 1]

// Start off with 0 length

int length = 0;

for i = 0 to s.length - 1

 // Binary search

 int low = 1

 int high = length

 while low <= high

 int middle = Ceil((low + high) / 2)

 if s[ends[middle]] < s[i]

 low = middle + 1

 else

 high = middle - 1

 // Update preds, and replace ends

```

    preds[i] = ends[low]
    ends[low] = i

    // Update length
    if (low > length)
        length = low

// Get longest increment subsequence
int[] longestIncSub = new int[length]
int j = ends[length]

for i = length - 1 to 0
    longestIncSub[i] = s[j]
    j = preds[j]

return longestIncSub

```

Binary search time is $O(\log n)$, which runs in a loop of n times.
 Therefore, run time is $O(n \log n)$

④

Build a table

match = 1
mismatch = -1
insertion/deletion = -1

	-	A	A	C	T
-	0	-1	-2	-3	-4
G	-1	1	-2	-3	-4
A	-2	0	1	-2	-3
T	-3	-2	-1	0	-1

- go through the values
- and pick best result for
3 cases which are labelled
with arrows

Trace back

	-	A	A	C	T
-	0	-1	-2	-3	-4
G	-1	1	-2	-3	-4
A	-2	0	1	-2	-3
T	-3	-2	-1	0	-1

{ A A C T
G A C T

horizontal arrow, so
there is a gap

∴ That is the optimal sequence alignment, so the score
= 10