

Mathematical Analysis:

Alternating Disk / Algorithm 1

The program is a sequence containing light and dark disks that moves in an alternating pattern, where there cannot be a repeating light or dark disk. Building upon and deleting some parts from the linked list algorithm displays a time complexity of $O(N)$ because there is a one-to-one cardinality between the actions. However, the time complexity differs in the core part of the algorithm, specifically in the recursiveSort function. Each call from the recursive function has a time complexity of $O(1)$ because there is a constant number of comparisons and possible swaps from the left and right. The worst-case scenario for the program in terms of time complexity would result in a maximum of $O(n^2)$, which is dependent on the depth and the distance of travel it needs. Through induction,

Assume that for any list of Size k , the algorithm sorts itself in $O(k^2)$ time, where the base case immediately returns to $O(1)$ through a single node.

The inductive step is $(n = k + 1)$ where the work would be: $T(k+1) = O(k) + O(k^2) = O((k+1)^2)$

Thus, by induction, the algorithm runs in quadratic time as a Doubly Linked List.

Matching Schedule Groups / Algorithm 2

To understand what the algorithm does, each person is given a schedule and an availability window where the code is implemented to find gaps between filled time slots, called AvailabilityInterval. It can compare two available intervals to find meeting slots using the FindTimes function. The complexity of AvailabilityInterval is $O(n^2)$ due to the algorithm iterating through the schedule once to check for gaps, since the code is set up to be an array. The time complexity of FindTimes has two inputs, which are used to scan the two inputs twice. This would be an $O(n+m)$ time complexity. Overall, the entire code, when all the functions are working together, would mean that when finding and determining available time slots in the schedule for person 1 and person 2, it would lead the time complexity of the entire algorithm to be $O(n_1+n_2)$, meaning it is linear to the schedule size.

The algorithm runs in linear time, which is related to the number of intervals that are full in the schedule at $O(n_1+n_2)$.