

Z5188675 Zijian Yue

Q1.

1. Assume n songs, the song i will have l_i , CD start with index i .
2. Variable counter is used to record the number of iterations starting from 1.
3. Variable counter_CD is used to record the current number of the CD.
4. Variable current_sum is used to record the total minutes for the current CD.
5. Assume the length of an individual song is less than m .
6. Having n iterations (n is the number of songs in 1)
 - 6.1 $\text{current_sum} = \text{current_sum} + \text{song}[\text{counter}]$
 - 6.2 If $\text{current_sum} > m$
 - 6.2.1 $\text{current_sum} = \text{song}[\text{counter}]$
 - 6.2.2 $\text{counter_CD} += 1$
 - 6.3 $\text{CD}[\text{counter_CD}].\text{append}(\text{song}[\text{counter}])$
 - 6.4 $\text{counter} += 1$

Justification:

The program goes through from the very first song to the last song, try to determine which album each song should be recorded. The program will satisfy condition (a) because it does not change the order of the song when it is trying to record the songs to different CDs. The program also satisfies condition (b) because it will try to record all the songs from the first song to the last one, if a CD is full, the program will start to record the song to a new one. The program also satisfies condition (c) as it will use a new CD to record a song if the previous CD will be overflowed when a song is recorded. Therefore the algorithm is correct by stratifying all three requirements.

Time complexity:

There is only one loop in the program, thus the time complexity of the loop is simply the size of the total numbers of the song, for contents inside the loop

For 6.1 If Songs is an array, then time complexity is $O(1)$, if the songs are implemented as linked list, then time complexity will be $O(n)$.

For 6.2 If Songs is an array, then time complexity is $O(1)$, if the songs are implemented as linked list, then time complexity will be $O(n)$.

For 6.3 If CD is an array, then the time complexity is $O(n)$, if the CD is implemented as linked list, then time complexity will be $O(1)$

Therefore the overall time complexity is $O(n^2)$

