

COMP3121 21T2 Assignment 2 Q1

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The most efficient algorithm in order to minimise the number of CD needed can be composed by greedy algorithm. Since the requirements state songs must recorded in given order, all songs must be included, and songs cannot be split across CDs, hence songs will be recorded one by one in given ascending order with the assumption of length of song must shorter than storage size of CD. The algorithm starts with comparing the size difference between current song length l_i , and the size of storage left in the current CD s_k , which is total size of CD m minus the sum of all songs already stored in the current CD. If $l_i < s_k$, that means the current song can be fitted into CD, then record current song into current CD, and proceed next song. Otherwise, there is not enough space for current song, then record current song into next CD. Repeat the processes until all songs have been recorded into CDs, the total amount of CDs A have been used, are optimum under given requirements. Overall the time complexity of this algorithm can be achieved by $O(n)$, where n is the number of given songs.

This algorithm can be proven by contradiction. If the amount of CDs required is not optimal, then optimal amount of CD must smaller than A . Considering the last CD element CD_{k-1} in optimal algorithm, CD_{k-1} suppose to fit all of the rest songs and all the songs are recorded. However, the greedy algorithm created another CD CD_k , which means there is unrecorded song exists. Hence the contradiction proves the optimal algorithm is greedy algorithm.