We have a machine that we want to run different programs on according to a schedule (start time and execution duration) everyday. We want to check if a new program can be added to the schedule on the same machine.

1) Only 1 program can be running at any given time.

Schedule : [1, 3] , [5,8], [10, 12]

testprogram [4, 3]

canAccomodate(Schedule, testProgram) -> true/false

[1, 3] , [5,8], [10, 12]

[4, 3]

mid =

bool canAccomodate(vector<vector<int>>& schedule, vector<int>test){

  int n = schedule.size();

  if(n == 1){

    if(schedule[0][0]+schedule[0][1] <= test[0] ||

       test[0]+test[1] <= schedule[0][0])

        return true;

    return false;

  }

  // for inserting before the first element

  if(test[0]+test[1] <= schedule[0][0]) return true;

  int l = 0, r = n-1, mid, idx = 0;

  while( l < r){

    mid = l + (r-l)/2;

    // need to find the index of smaller start time

    if(schedule[mid][0] == test[0]) return false;

    if(schedule[mid][0] < test[0]){

     l = mid+1;

     idx = mid;

    }

    else{

     r = mid-1;

    }

  }

  if(schedule[idx][0]+schedule[idx][1] <= test[0] &&

     ( idx+1 == n || schedule[idx+1][0] >= test[1]+test[0]))

    return true;

  return false;

}

[2,2] , [4,4] , [6,6] , [8,8] [10,10] -> [1,1]

mid = 2=> idx = 2, l = 3, r = 4

mid = 3=>

T = O(logn)

S = O(1)

2) Only 4 programs can be running at any given time.

l = smallest start time

r = maximum time

arr = size r-l+1, m

[0003200] test =[a,b]

[ 1 3] = [1, -1]

m + n,  for each m time

void getMaxMin(vector<vector<int>>& schedule, int& l, int& r ){

l = schedule[0][0];

r = schedule[][]

}

bool canAccomodate(vector<vector<int>>& schedule, vector<int>test){

  int n = schedule.size();

  int l, r;

  getMaxMin(schedule, l , r);

  int m = r-l+1;

  vector<int> arr(m, 0);

  // TODO: support test.start time on the same time as one schedule finish

  for(vector<int>& vec : schedule){ [2, 7]

    arr[vec[0]-l] += 1;    [2,3] => [1 0 -1 0 ] => [1 ,1 ,0, 0]

    arr[vec[1]-l+1] -=1;

  }

  for(int i=1; i < m; i++)

    arr[i]+= arr[i-1];

  for(int j = test[0]; j <= test[1]; j++){

    if(arr[j-l] >= 4) return false;

  }

  return true;

}