ADA Homework 3 B03902089 林良翰

Problem 1.(1)

Sad case:

$$t_i = \{ f + (s+1) \times k \mid k \text{ is integer} \}$$

Problem 1.(2)

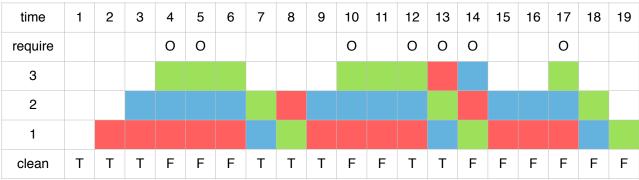
f = 1, if s = 3, we can create the table :

time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
require			0				0	0	Ο	0			0				0
clean fish	F	Т	F	F	F	Т	F	F	Т	F	F	Т	F	F	F	Т	F
fish num	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1

```
cleanTimeList = [ ]
function findCleanTime(t_list, s, cleanTimeList) :
    for i = 0 to size of t_list-1 :
        if i < 1 :
            add t_list[i]-1 to cleanTimeList
        else :
            if cleanTimeList.last + (s+1) ≤ t_list[i] :
                add (t_list[i]-1) to cleanTimeList
            end if
        end if
        end for
        return cleanTimeList
end function</pre>
```

Problem 1.(3)

If f = 3, s = 5, we can make a special table :



By observing the table, we need to verify every t_i whether it has enough fish by traversing the last few elements of cleanTimeList

```
cleanTimeList = [ ]
n = 0
for i = 0 to size of t_list-1 :
```

```
if i < 1:
           for j = 1 to f:
                add t_list[i]-j to cleanTimeList[n]
           end for
     else:
           curFish = 0
           for j = 1 to f:
                if cleanTimeList[n-j] + s ≥ t_list[i]
                      curFish++
                else: break for
           end for
           for j = 1 to f-curFish :
                add t_list[i]-j to cleanFishList[n]
                n++
           end for
     end if
end for
```

Problem 2.(1)

By definition, define "F" to be the influence :

$$F = \frac{1}{T} \sum_{i=1}^{N-1} b_i \sum_{j=i+1}^{N} p_j$$

problem 2.(2)

original	new					
b_{i-1} ($p_i+p_{i+1}+p_{i+2}+p_{i+3}p_n$)	b_{i-1} ($p_{i+1}+p_i+p_{i+2}+p_{i+3}p_n$)					
b_i ($p_{i+1}+p_{i+2}+p_{i+3}p_n$)	b_{i+1} ($p_i+p_{i+2}+p_{i+3}p_n$)					
b_{i+1} ($p_{i+2}+p_{i+3}p_n$)	b_{i} ($p_{i+2}+p_{i+3}p_{n}$)					

The difference =

$$\Delta F = \frac{b_{i+1}p_i - b_i p_{i+1}}{T}$$

Problem 2.(3)

```
Define f(S) to be the influence of the sequence S It is ensured that f(S_{swap(k,k+1)}) < f(S), suppose that f(S_{swap(k,k+2)}) > f(S): In the other word, sequence <...k+2, k+1, k,...> is more influent By original definition : f(S_{swap(k,k+1)}) < f(S)f(S_{swap(k+1,k+2)}) < f(S)\Rightarrow f(S_{swap(k,k+2)}) < f(S)contradiction!
```

Problem 2.(4)

Design the merge sort which complexity is $O(n\log n)$ And we use the compare function which return difference (problem2.2) ΔF Finally we will find the sequence.

problem 2.(5)

```
1 #include <cstdio>
 2 #include <vector>
 3 #include <algorithm>
4 using namespace std;
5
6 class element {
       int p; // price
int b; // influence level
8
9
       element(int _p, int _b) {
10
11
           p = p;
12
           b = _b;
13
       }
14 };
15
16 bool operator<(const element &n1, const element &n2)
17 {
       if (n2.b * n1.p - n1.b * n2.p < 0) return true;
18
19
          se return false;
20 }
21
22 int main()
23 {
24
       vector<element> seq;
25
       int p, b;
26
27
       // read the original sequence
28
29
       sort(seq.begin(), seq.end()); // time complexity O(nlogn)
30
31
32
33
       return 0;
34
```

Problem 3.(1)

```
If Paul choose one some element out of \{a_{[1]1}, a_{[3]1}, a_{[5]1}..., a_{[2n+1]1} | n \text{ is integer}\}
\Rightarrow Paul doesn't use optimal strategy
\Rightarrow Contradiction!
\Rightarrow Paul must choose the element in : \{a_{[1]1}, a_{[3]1}, a_{[5]1}..., a_{[2n+1]1} | n \text{ is integer}\}
We can also prove that John have to choose the element in : \{a_{[2]1}, a_{[4]1}, a_{[6]1}..., a_{[2n]1} | n \text{ is integer}\}
```

problem 3.(2)

We just concentrate on a pile of cards i_n Paul and John all choose n_i , then :

- \Rightarrow Paul will get a_{i1} , a_{i2} , ..., $a_{i(ni/2)}$
- \Rightarrow John will get $a_{i(ni/2+1)}$, ..., a_{ini}

sum up every piles :

Paul will get at least a score of

$$\sum_{i=1}^{N} \sum_{j=1}^{\frac{n_i}{2}} a_{ij}$$

John will get at least a score of

$$\sum_{i=1}^{N} \sum_{\substack{j=\frac{n_i}{2}+1}}^{n_i} a_{ij}$$

problem 3.(3)

warning : problem too difficult

problem 3.(4)

warning : problem too difficult