



On tasks and subtasks

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Dutch Informatics Olympiad (NIO)



A short story on bridge (the game)

- Every player gets 13 cards out of 52
- There are 4 suits:



- Players like to sort or group their hands
- Usually they do it suit by suit,
and red – black – red - black

Example



Red – Black – Red – Black





A task idea

- Given 13 cards
- Order them by taking out one card at a time and inserting it at a proper spot
- Minimize the number of cards you have to replace



The one task approach

- Given an input and output format, a goal, find a way to rearrange the cards according to this goal
- Contestants write a program that is:
 - Wrong
 - Correct, but sloppy or slow
 - Working well



Contestants second round NIO

- Many contestants from the first round (at home) are invited
- There are large differences in age, skill and experience
- We need to come down to 8-12 contestants
- We want the youngsters to come back next years



Subtasks

- Everyone should be able to get some credits
- We want to see how much contestants can achieve in a short time
- Using subtasks I can give a hint for the solution
- It is possible to do some other tasktype questions in the same context



Task CARDS

Subtask	Goal	Maximum
A	Read and proces the input file	10
B	Find the longest proper sorted substring of the input	30
C	Find the longest proper sorted sub-sequence in the input	40
D	Identify all possible sorted hands given this input	20
E	Find the shortest path to a sorted hand	50
Total (out of 400 in the second round)		150

Example input



S	H	R	H	H	S	K	S	S	H	H	R	S
1	2	3	4	5	6	7	8	9	10	11	12	13



Subtask B: Longest sorted substring

S	H	R	H	H	S	K	S	S	H	H	R	S
1	2	3	4	5	6	7	8	9	10	11	12	13



Subtask C: Longest sorted subsequence

S	H	R	H	H	S	K	S	S	H	H	R	S
1	2	3	4	5	6	7	8	9	10	11	12	13



Subtask D:

Identify possible sorted hands

SSSSSHHHHKKR

KKHHHHSSSSSR

SSSSSRKKHHHH

KKRSSSSSHHHH

HHHHSSSSSRKK

RSSSSSHHHHKK

HHHHKKRSSSS

RKKHHHHSSSS



Subtask E: Order the cards

- You need to be able to solve subtask D
- It is helpful to have solved subtask C
- If you could solve D or even C, but not E, you would get no credits in a one-task-approach



Other types of subtasks: Output only

- Produce a sample input file where the cards are so mixed up that the solution for subtask E is maximal



Other type of subtasks: Improve the result

- In subtask E you were only able to move one card at a time. If you are able to pick up a number of adjacent cards, can you improve the minimum number of steps to a sorted hand?
- We don't ask for the best way, just a better one than the one-card-at-a-time solution

S	H	R	H	H	S	K	S	S	H	H	R	S
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

1 2 3 4 5 6 7 8 9 10 11 12 13

S	H	H	H	R	R	H	H	S	K	S	S	S
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

1 2 3 4 5 6 7 8 9 10 11 12 13

H	H	S	S	H	H	H	R	R	K	S	S	S
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

1 2 3 4 5 6 7 8 9 10 11 12 13

H	H	H	H	H	S	S	R	R	K	S	S	S
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

1 2 3 4 5 6 7 8 9 10 11 12 13

H	H	H	H	H	S	S	S	S	S	R	R	K
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

1 2 3 4 5 6 7 8 9 10 11 12 13



Using subtasks

Second round NIO

- Helps for the nicely spread score distribution
- Gives contestants the possibility to show what they can
- Enables the use of other task types
- Gives you more opportunities to use the problem context

At IOI?

- We are always looking for a nicely spread score distribution
- Sometimes there is more between solved and failed
- We did it twice in the IOI-history
- Maybe we should consider using them again