

## Introduction to Computer Science E15 – Study Groups – Week 37

Divide into groups of about four people to do the following:

1. In each group, one person will choose five cards to give to the first “performer”, the first performer will give four of them to the second “performer”, one at a time, and the second performer will announce what the fifth card is. Each person should practice each “performer” part at least two times.
2. Each group should write down the algorithm for the original card trick, clearly and unambiguously. Do not write more than is necessary, but do not leave out necessary information. Use the following notation:

Let  $V = \{2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K, A\}$  be the set of values of the cards. Define the following ordering on these values:

$$2 < 3 < 4 < 5 < 6 < 7 < 8 < 9 < 10 < J < Q < K < A.$$

Let  $S = \{\text{club, diamond, heart, spade}\}$  be the set of suits, and define the following ordering on these values:

$$\text{club} < \text{diamond} < \text{heart} < \text{spade}.$$

Assume that the two performers have agreed in advance on the following ordering of all 52 cards in the deck: For two cards  $(s_1, v_1)$  and  $(s_2, v_2)$ , where  $s_1, s_2 \in S$  and  $v_1, v_2 \in V$ , we say that  $(s_1, v_1) < (s_2, v_2)$  if and only if  $v_1 < v_2$  or  $(v_1 = v_2$  and  $s_1 < s_2)$ .

The output of the first performer’s algorithm (and the input to the second performer’s algorithm) is four cards,

$$(s_1, v_1), (s_2, v_2), (s_3, v_3), (s_4, v_4),$$

where  $s_1, s_2, s_3, s_4 \in S$  and  $v_1, v_2, v_3, v_4 \in V$ . The output of the second performer’s algorithm should be one card  $(s', v') \in (S, V)$  defining which card the first performer has remaining.

- Write two algorithms, one for each performer.
- Find another group and exchange algorithms with that other group. Check the algorithm your group received to see if it is clear and unambiguous (that it can be understood, without any doubts about any cases). Give comments to the group that wrote it.  
In giving comments, try to read the algorithm as if you did not already know what it should do. Are there any steps which are unclear?
- Improve the pseudocode for your algorithm and exchange with another group.

3. This and the remaining questions can be done in your study groups without advisors if you run out of time.

Propose at least one method for improving the magic trick. For example, if the first card determines the suit, after seeing the trick repeated several times, the audience might find it easier to guess how it is done. Define an algorithm for a modification of the trick which makes this harder to see.

4. Propose an algorithm for doing a magic trick, where one performer is thinking of a number between 1 and 24, tells the audience the number, gets some cards from the audience, and passes some cards to the second performer, who announces the number.
5. Discuss questions 2, 4 and 5 on pages 28–29 of the textbook.