Computationally Hard Problems

Student name and id: Anders H. Opstrup (s160148)

Collaborator name(s) and id(s): Salik Lennert Pedersen (s134416)

Hand-in for week: 1

Exercise 1

A chess game configuration describes the current state in the well known chess game. Such a state includes the positions of the up to 32 available pieces on the 8 x 8-chess board and the color of the player whose turn it is next. The aim is to design a formal language L_{chess} for chess game configurations.

a)

Specify the alphabet $\sum_{chess}$ you use.

$\sum_{chess}$ = {a, b, c, d, e, f, g, h, 1, 2, 3, 4, 5, 6, 7, 8, +, -, #, Q, K, N, B, R, P}

Description of letters

Short description of the given letters in the alphabet $\sum_{chess}$

Letters: a, b, c, d, e, f, g, h, 1, 2, 3, 4, 5, 6, 7, 8
Describe the position of a piece on the board

Letters: +, -
Describe the colors of the piece (- white, + black)

The Letter: #
Describe the beginning of a new fragment in the word

The Letters: Q, K, N, B, R, P
Describe the class of the piece.
Q: Queen
K: King
N: Knight
B: Bishop
R: Rook
P: Prawn

b)

Specify how a chess game configuration is encoded in the language L_{chess}.

Rules for L_{chess}

1. We only describe positions with pieces.
2. First fraction describe which turn it is.
3. When describing the position of a piece, we first tell the color of the piece, followed by the position on the board (letters first), followed by the letter representing the piece.

c)

Describe how one can check whether a given word $\omega \in \sum^*_{chess}$, and, if so, how the game configuration can be reconstructed.

The word is incorrect if $|\omega| <$ minLength or if $|\omega| >$ maxLength.
minLength = 2 next turn letters + 5 pieces letters = 7
maxLenght = 2 next turn letters + 5 pieces letters * 32 pieces = 162

A word must be able to be defined as following $\frac{|\omega|-2}{5} = \mathbb{N}$

d)

How would the initial game configuration (i. e., the configuration the game is set up to begin with) be encoded in your language?

$-\#+a8R\#+b8N\#+c8B\#+d8K\#+e8Q\#+f8B\#+g8N\#+h8R\#+a7P\#+b7P\#+c7P\#+d7P\#+e7P\#+f7P\#+g7P\#+h7P\#-a1R\#-b1N\#-c1B\#-d1K\#-e1Q\#-f1B\#-g1N\#-h1R\#-a2P\#-b2P\#-c2P\#-d2P\#-e2P\#-f2P\#-g2P\#-h2P$