ICS 2022 Problem Sheet #1

Problem 1.1

E = {} initialization, C = 0

Z = { {a}, {b}, {c}, {d}, {e}, {f} }

E = { (e, f) } step 1, C = 1

Z = { {a}, {b}, {c}, {d}, {e,f} }

E = { (e,f), (d,f) } step 2, C = 3

Z = { {a}, {b}, {c}, {d,e,f} }

E = { (e,f), (d,f), (c,f) } step 3, C = 7

Z = { {a,}, {b}, {c,d,e,f} }

E = { (e,f), (d,f), (c,f), (b,f) } step 4, C = 13

Z = { {a}, {b,c,d,e,f} }

E = { (e,f), (d,f), (c,f), (b,f), (a,f) } step 5, C = 21

Z = { {a,b,c,d,e,f} }

Problem 1.2

Consider the text t = F F L F L F R F R F F L F R F and the pattern p = F F L F R

a) Naive string search algorithm

t = F F L F L F R F R F F L F R F, p = F F L F R [10 alignments, 22 comparisons]

```
F F L F L F R F R F F L F R F
F F L F R
  F F  l  f  r
    F  f  l  f  r
       F F l  f  r
         F f  l  f  r
           F F l  f  r
             F f  l  f  r
               F F l  f  r
                 F f  l  f  r
                   F F L F R
```

b) Boyer-Moore: Bad character rule

t = F F L F L F R F R F F L F R F, p = F F L F R [6 alignments, 16 comparisons]

```
F F L  F L  F R  F R F F L F R F          skip
f f  l  f R                               1  realign to match F
    F  F  L  F R                          0  realign to match F
      f  f  l  f R                        0  realign to match F
        f  f  L  F  R                     2  realign to match F
              f f l f R                   1  realign to match F
                  F F L F R               pattern found
```

c) p = F F L F R

$$\begin{array}{c} \\ F \\ L \\ R \\ * \end{array}\begin{array}{c} \begin{array}{ccccc} 0 & 1 & 2 & 3 & 4 \end{array} \\ \begin{pmatrix} - & - & 0 & - & 0 \\ 0 & 1 & - & 0 & 1 \\ 0 & 1 & 2 & 3 & - \\ 0 & 1 & 2 & 3 & 4 \end{pmatrix} \end{array}$$

Problem 1.3

a) Operators that are neither left nor right associative: '>', '<'

When used multiple times in an expression (without additional parenthesis defining the evaluation order) they constitute syntax errors.

Example: a < b < c will provide a syntax errors, it should have been written as (a < b) and (b < c) and it is not equivalent to either (a < b) < c or a < (b < c).

b) The $ operator has a precedence of 0 and is right associative.

The prefix expression in infix notation, without the $ operator, using parenthesis where necessary:

(^) 2 ((*) 4 ((+) 1 3)