**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

**Problem 1.3**

1. 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).

1. 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 )