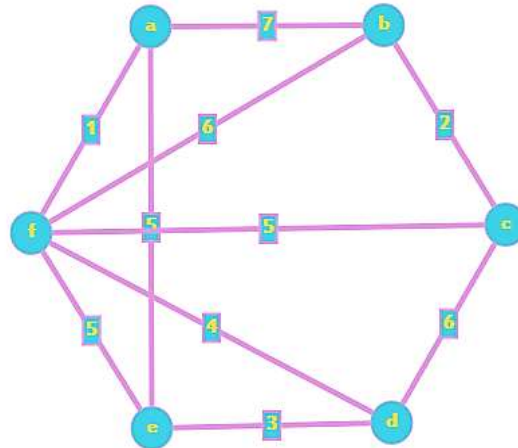


## Homework - CS 2020 Problem Sheet #1

### Problem 1.1



edge	(a, b)	(a, e)	(a, f)	(b, c)	(b, f)	(c, d)	(c, f)	(d, e)	(d, f)	(e, f)
cost	7	5	1	2	6	6	5	3	4	5

$E' = \{\}$

$A = \{\{a\}, \{b\}, \{c\}, \{d\}, \{e\}, \{f\}\}$

$C = 0$

$E' = \{\{a, f\}\}$

$A = \{\{a, f\}, \{b\}, \{c\}, \{d\}, \{e\}\}$

$C = 1$

$E' = \{\{a, f\}, \{b, c\}\}$

$A = \{\{a, f\}, \{b, c\}, \{d\}, \{e\}\}$

$C = 3$

$E' = \{\{a, f\}, \{b, c\}, \{d, e\}\}$

$A = \{\{a, f\}, \{b, c\}, \{d, e\}\}$

$C = 6$

$E' = \{\{a, f\}, \{b, c\}, \{d, e\}, \{d, f\}\}$

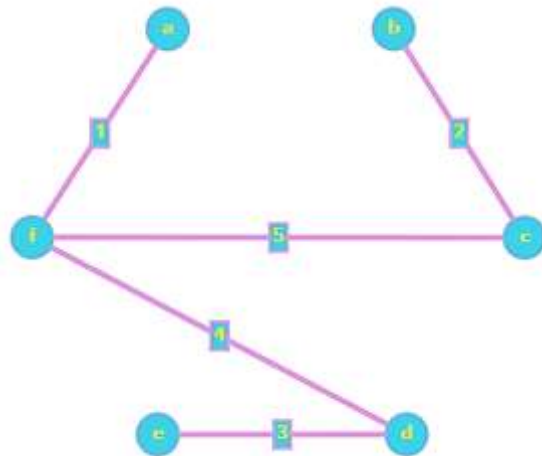
$A = \{\{a, f, d, e\}, \{b, c\}\}$

$C = 10$

$E' = \{\{a, f\}, \{b, c\}, \{d, e\}, \{d, f\}, \{c, f\}\}$

$A = \{\{a, f, d, e, b, c\}\}$

**$C = 15$**



## Problem 1.2

### a) Naive String Search

$t = \text{FFLFLFRFRFFLFRF}$

$p = \text{FFLFR}$

Align.	F	F	L	F	L	F	R	F	R	F	F	L	F	R	F	Comp.
1	F	F	L	F	R											5
2		F	F	l	f	r										2
3			F	f	l	f	r									1
4				F	F	l	f	r								2
5					F	f	l	f	r							1
6						F	F	l	f	r						2
7							F	f	l	f	r					1
8								F	F	l	f	r				2
9									F	f	l	f	r			1
10										<b>F</b>	<b>F</b>	<b>L</b>	<b>F</b>	<b>R</b>		5

Alignments: **10**

Comparisons:  $5 + 2 + 1 + 2 + 1 + 2 + 1 + 2 + 1 + 5 = \mathbf{22}$

### b) Boyer-Moore

Align.	F	F	L	F	L	F	R	F	R	F	F	L	F	R	F	Comp.
1	f	f	l	f	R											1
2			F	F	L	F	R									5
3				f	f	l	f	R								1
4					f	f	L	F	R							3
								f	f	l	f	R	F	R		1
										F	F	L				5

Alignments: **6**

Comparisons:  $1 + 5 + 1 + 3 + 2 + 5 = \mathbf{16}$

### c) Lookup table for the bad character rule

$\Sigma = \{L, R, F, P\}$

$p = \text{FFLFR}$

$\Sigma \backslash p$	F	F	L	F	R
L	0	1	-	0	1
R	0	1	2	3	-
F	-	-	0	-	0
P	0	1	2	3	4

### Problem 1.3

- a) In the case of a non-associative operator, after compiling an expression you get an error because the operator wouldn't know in what order/precedence to execute the operation. An example would be the operator of double equality, less than equal operator or the infix operator. I.e.  $(a :- b :- c)$  would constitute syntax errors, as  $:-$  is non-associative.
  - b) The role of the \$ operator is to give us a function application with an "opposite" associativity and precedence (anything appearing after it will take precedence over anything that comes before). The operator itself is an infix operator with right associativity, and has the lowest precedence possible.
- prefix expression:  $(^) 2 \$ (*) 5 \$ (+) 2 3$   
otherwise  $(^) 2 ((*) 5 ((+) 2 3))$  – brackets instead of \$ operator
  - in infix notation without the \$ operator:  $2 ^ (5*(2+3))$
- Both notations have 33554432 as result.