# Problem 1.1 solution

Given,

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

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

Now, lets construct a spanning tree G(V, E') using Kruskal's algorithm

Start	E = {} A = {{a}, {b}, {c}, {d}, {e}, {f}}	C=0
Step 1:	E = {(a, f)} A = {{a, f}, {b}, {c}, {d}, {e}}	C=1
Step 2:	E = {(a, f), (b, c)} A = {{a, f}, {b, c}, {d}, {e}}	C=3
Step 3:	E = {(a, f), (b, c), (d, e)} A = {{a, f}, {b, c}, {d, e}}	C=6
Step 4:	E = {(a, f), (b, c), (d, e), (d, f)} A = {{a, f, d, e}, {b, c}}	C=10
Step 5:	E = {(a, f), (b, c), (d, e), (d, f), (c, f)} A = {{a, f, d, e, b, c}}	C=15
End	$E = \{(a, f), (b, c), (d, e), (d, f), (c, f)\}\$ $V = \{a, b, c, d, e, f\}$	C=15

Hence, the minimum value of the cost function is 15.

## **Problem 1.2 Solution**

```
Given:
```

```
\sum = \{L, R, F, P\}
t = FFLFLFRFRFFLFRF
n = 15 \qquad \text{(length of text t)}
p = FFLFR
m = 5 \qquad \text{(length of pattern p)}
```

#### 1.2a solution)

Using naïve string search algorithm,

```
FFLFLFRFRFFLFRF
FFLFR
FFlfr
FFlfr
FFlfr
FFlfr
FFlfr
FFlfr
FFlfr
FFLFR
```

No. of alignments = 10 No. of comparisons = 22

### 1.2a solution)

Using Boyer-Moore bad character rule algorithm,

```
FFLFLFRFRFFLFRF

ff1fR

ff1fR

ffLFR

ff1fR

ffLFR

No. of alignments = 6
No. of comparisons = 16
```

### 1.2c solution)

Post.	F 0	F 1	L 2	F 3	R 4	Positions of Pattern p FFLFR 01234
F	-	-	0	-	0	
L	0	1	-	0	1	No. of alignments that can be skipped if comparison does not match.
R	0	1	2	3	-	
P	0	1	2	3	4	"-" means Comparison matches

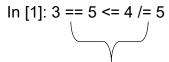
The values in the table denote the number of alignments that can be skipped if there is a mismatch. Hyphen means the comparisons match.

## Problem 1.3 solution

#### 1.3a Answer

The operators which are neither right associative nor left associative are called non-associative operators. If such operators having same precedence level appear multiple times in an expression, then we will get a **precedence error**. The non-associative operators in Haskell are ==, /=, <, <=, >=, > which have precedence level 4.

e.g.



Cannot decide which operator to execute first because they are non-associative and have same precedence level.

#### 1.3b Answer)

The precedence of \$ is zero in Haskell and it is right associative.

The infix notation of ( $^{\circ}$ ) 2 \$ ( $^{*}$ ) 5 \$ ( $^{+}$ ) 2 3 is 2 $^{\circ}$ (5 $^{*}$ (2+3)).