EXERCISES - 3

Ex 9

Weighted CSP

Consider a weighted CSP

- with three variables X, Y, Z
- with domains $D_X=\{a,b\}$, $D_Y=\{c,d\}$, and $D_Z=\{f,g\}$
- with five weighted constraints
  - c1= $\langle f_1, \{X\}\rangle$
  - c2= $\langle f_2, \{Y\}\rangle$
  - c3= $\langle f_3, \{Z\}\rangle$
  - c4= $\langle f_4, \{X,Y\}\rangle$
  - c5= $\langle f_5, \{Y,Z\}\rangle$

  where f_i, i=1,..5 are shown in the next slide

Weighted CSP

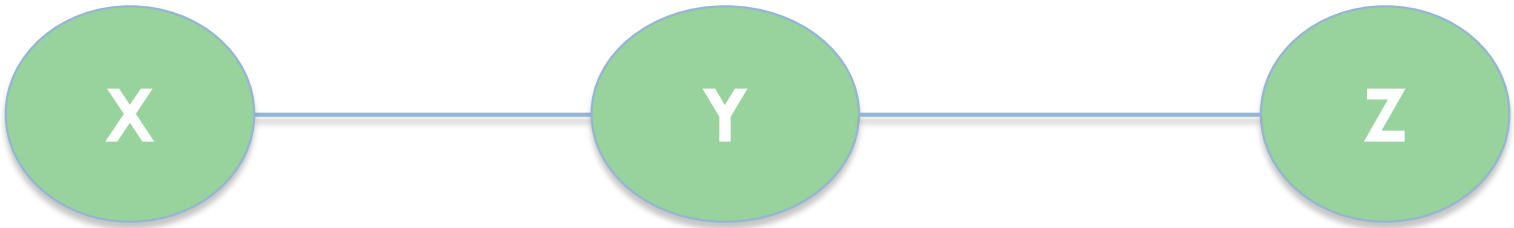
weighted constraints

- c1= <f_1, {X} >
- c2= <f_2, {Y}>
- c3= <f_3, {Z}>
- c4= <f_4, {X,Y}>
- c5= <f_5, {Y,Z}>

$f_1(a) = 15$
$f_1(b) = 10$

$f_2(c) = 20$
$f_2(d) = 25$

$f_3(f) = 45$
$f_3(g) = 20$



$f_4(a, c) = 10$
$f_4(a, d) = 15$
$f_4(b, c) = 25$
$f_4(b, d) = 20$

$f_5(c, f) = 30$
$f_5(c, g) = 40$
$f_5(d, f) = 45$
$f_5(d, g) = 60$

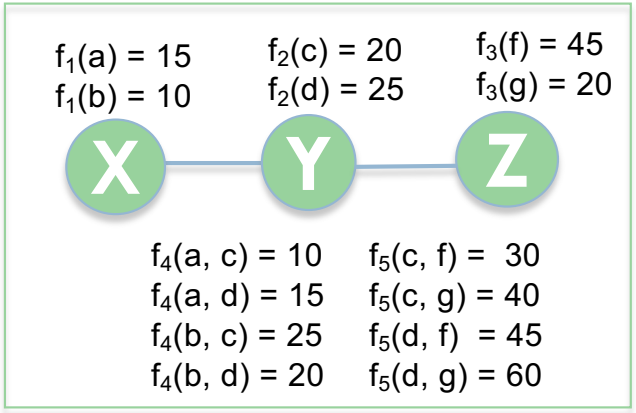
Weighted CSP

- Define the constraint obtained by combining the weighted constraints c1, c2, c3, c4, c5

- What is the optimal solution of the weighted CSP?

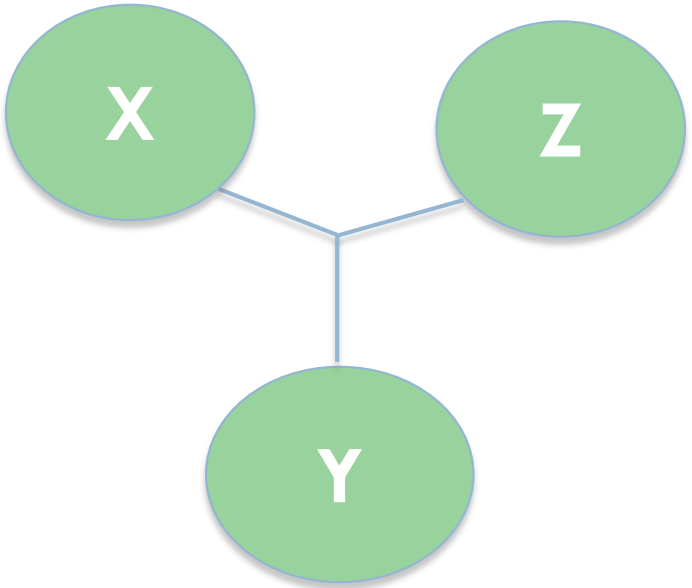
- What is the preference value of the optimal solution?

1. Define the constraint obtained by combining the weighted constraints c1, c2, c3, c4, c5



Weighted c-semiring

$S_{FCSP} = \langle R^+ \cup \{+\infty\}, min, +, +\infty, 0 \rangle$



The combined constraint is

c6= < f6, {X,Y,Z} >, where

X Y Z

f6(a, c, f) **= f1(a) + f2(c) + f3(f) + f4(a,c) + f5(c,f)**

= 15 + 20 + 45 + 10 + 30 = **120**

f6(a, c, g) = 15 + 20 + 20 + 10 + 40 = **105**

f6(a, d, f) = 15 + 25 + 45 + 15 + 45 = **145**

f6(a, d, g) = 15 + 25 + 20 + 15 + 60 = **135**

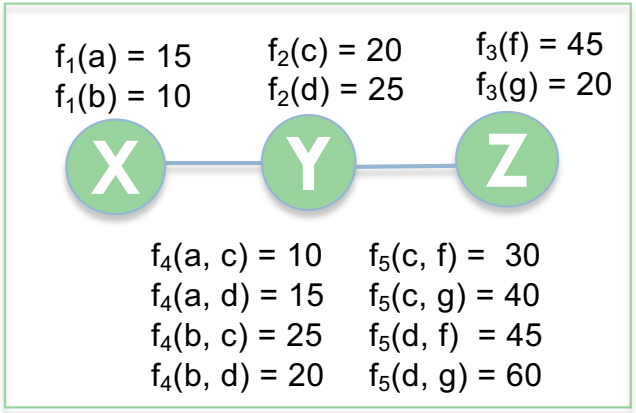
f6(b, c, f) = 10 + 20 + 45 + 25 + 30 = **130**

f6(b, c, g) = 10 + 20 + 20 + 25 + 40 = **115**

f6(b, d, f) = 10 + 25 + 45 + 20 + 45 = **145**

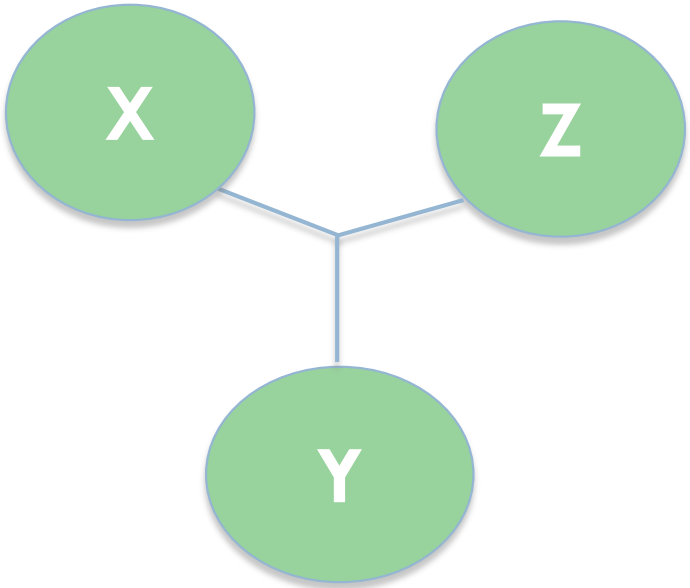
f6(b, d, g) = 10 + 25 + 20 + 20 + 60 = **135**

2. What are the optimal solutions of the weighted CSP?
3. What is the preference value of the optimal solutions?



Weighted c-semiring

$S_{FCSP} = \langle R^+ \cup \{+\infty\}, min, +, +\infty, 0 \rangle$



X Y Z

Optimal solution: **s = (a, c, g)**

Preference value of the optimal solution is **105**

The combined constraint is

c6= < f6, {X,Y,Z} >, where

X Y Z

f6(a, c, f) **= f1(a) + f2(c) + f3(f) + f4(a,c) + f5(c,f)**

= 15 + 20 + 45 + 10 + 30 = **120**

f6(a, c, g) = 15 + 20 + 20 + 10 + 40 = **105**

f6(a, d, f) = 15 + 25 + 45 + 15 + 45 = **145**

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f6(b, c, g) = 10 + 20 + 20 + 25 + 40 = **115**

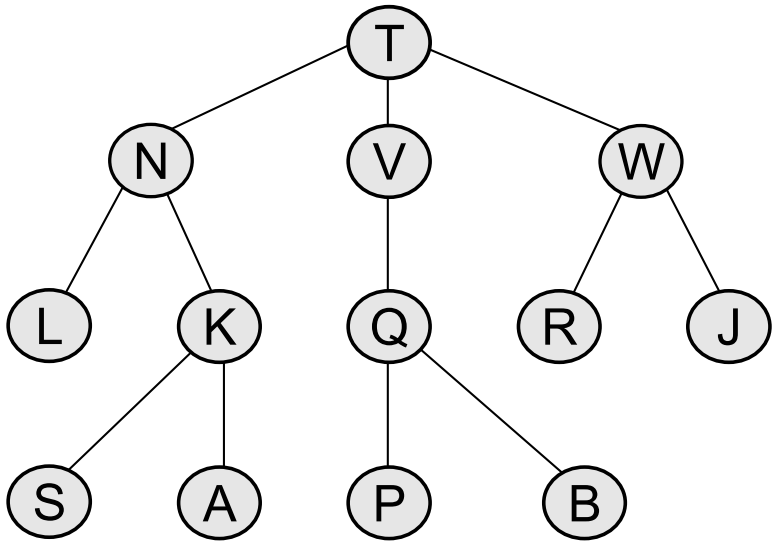
f6(b, d, f) = 10 + 25 + 45 + 20 + 45 = **145**

f6(b, d, g) = 10 + 25 + 20 + 20 + 60 = **135**

Ex 10

Search strategies

- Enumerate the order in which all nodes (of the tree below) are chosen for expansion by the following search strategies:
  - Depth First Search
  - Breadth First Search
  - Iterative Deepening Search



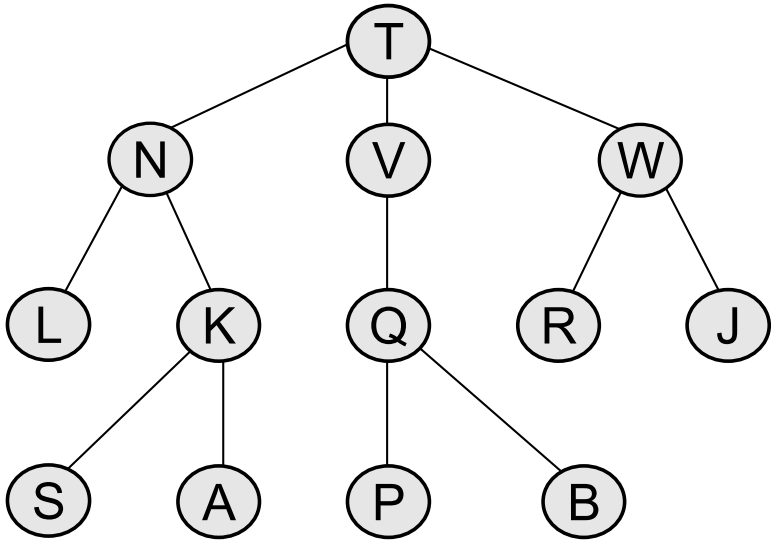
Review: Search strategies

- A search strategy is defined by picking the order of node expansion

- Breadth-first search expands the shallowest unexpanded node first
- Depth-first search expands the deepest unexpanded node first
- Iterative deepening search calls depth-first search with increasing depth limits until a goal is found

Search strategies

Depth-first search expands the deepest unexpanded node first

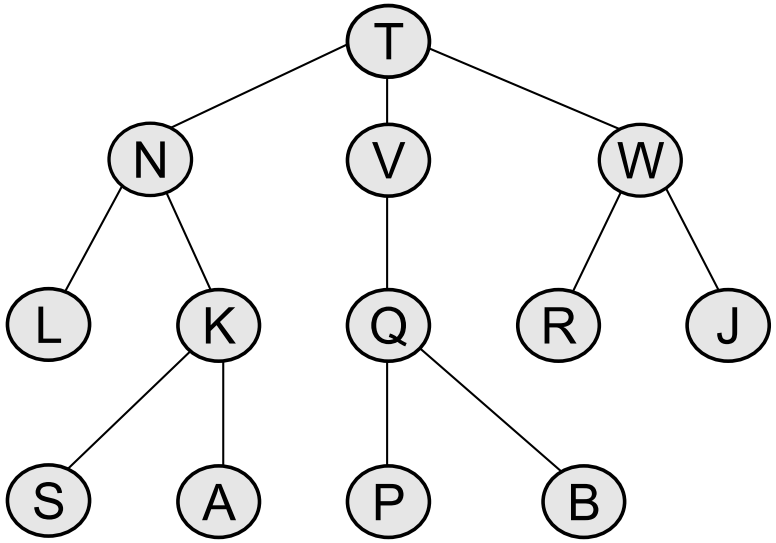


- Depth First Search

  T N L K S A V Q P B W R J

Search strategies

Breadth-first search expands the shallowest unexpanded node first

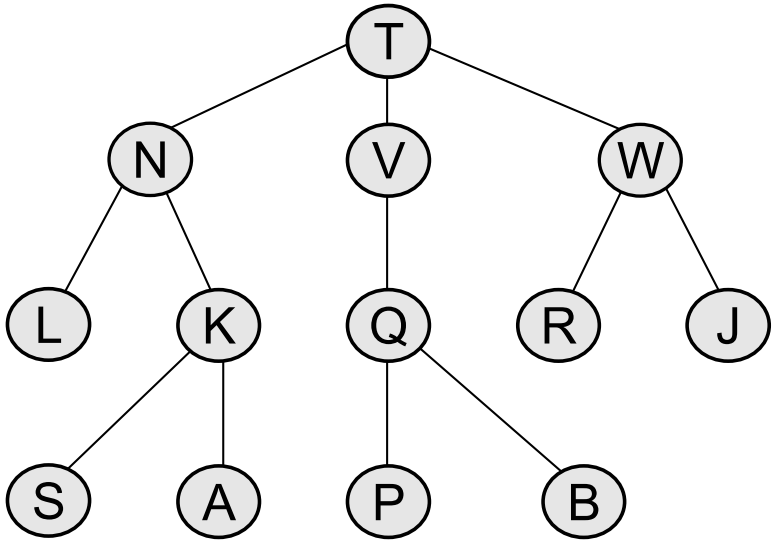


- Breath First Search

T N V W L K Q R J S A P B

Search strategies

Iterative deepening search
calls depth-first search
with increasing depth limits
until a goal is found



- Iterative Deepening Search

T; T N V W; T N L K V Q W R J; T N L K S A V Q P B W R J