Homework 2

Class	50.021 Artificial Intelligence
Created	@Jun 5, 2021 4:55 PM
Materials	2021_theoryhw_csp.pdf
Reviewed	☐
Type	Homework
Week	3

Question 1

Compare between standard search problems and constraint satisfaction problems. List down two similarities and three differences.

Similarities:

- They both have states, to physically represent a configuration of the problem, so that it is possible to work towards a goal.
- They both have goals, and goal tests to see if the programme has arrived at a state that is the goal.

Differences:

- SSP is more interested in the sequence of actions (path) to the goal while CSP is more interested in the goal itself, not the sequence of actions (path) there
- For SSP, paths have various costs and depths while for CSP, all paths have the same depth (for some formulations)
- For SSP, the state space is quite broad, and can be strings, or countries etc, while for CSPs, the states are represented by variables X_i which can take on values from domain D_i

Question 2

Formulate this as a CSP problem, by stating all variables, domains and constraints.
Also, draw the corresponding constraint graph.

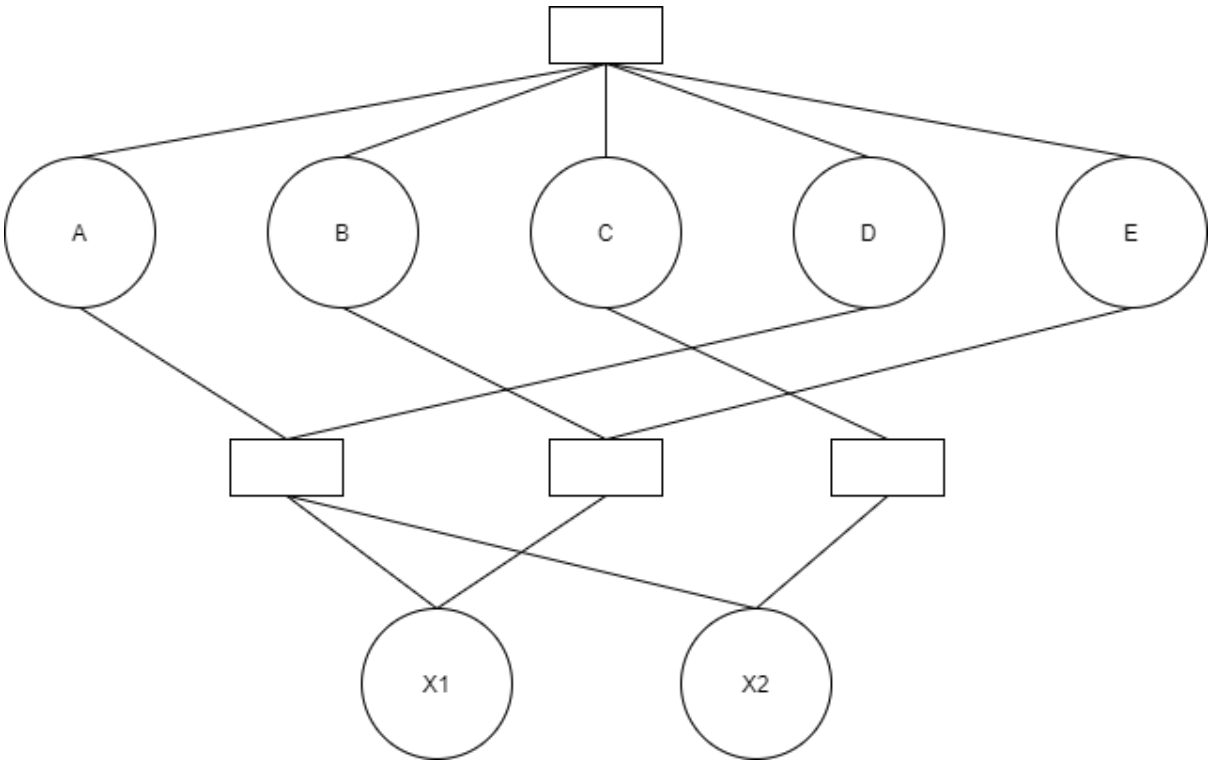
Variables: A, B, C, D, E, X_1, X_2

where X_1, X_2 represent the carryover for each decimal position

Domains: $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Constraints:

- $\text{alldiff}(A, B, C, D, E)$
- $B + B = E + X_1 \cdot 10$
- $A + A + X_1 = D + X_2 \cdot 10$
- $C = X_2$



Question 3

Variable	Colour	Inconsistency found
$V1$	R	
$V2$	G	
$V3$	R	$\times$
$V3$	G	
$V4$	G	$\times$
$V2$	B	
$V3$	R	$\times$
$V1$	G	
$V2$	G	$\times$
$V2$	B	
$V3$	R	
$V4$	G	solution

$\therefore$ the solution is $\{V1 : G, V2 : B, V3 : R, V4 : G\}$

Question 4

Variable	Colour	Domain empty
$V1$	R	
$V2$	G	$\times$
$V2$	B	
$V3$	G	$\times$
$V1$	G	
$V2$	B	
$V3$	R	
$V4$	G	solution

*may change depending on profs answer

Question 5

Variable	Variable	Domain	Domain
$V1$	$V2$	$D1 : RGB$	$D2 : GB$
$V4$	$V2$	$D4 : G$	$D2 : GB$
$V1$	$V3$	$D1 : RGB$	$D3 : RG$
$V2$	$V1$	$D2 : GB$	$D1 : RGB$
$V2$	$V4$	$D2 : \cancel{G}B$	$D4 : G$
$V3$	$V1$	$D3 : RG$	$D1 : RGB$
$V3$	$V4$	$D3 : R\cancel{G}$	$D4 : G$
$V4$	$V3$	$D4 : G$	$D3 : R\cancel{G}$
$V1$	$V2$	$D1 : RG\cancel{B}$	$D2 : \cancel{G}B$
$V4$	$V2$	$D4 : G$	$D2 : \cancel{G}B$
$V1$	$V3$	$D1 : \cancel{R}G\cancel{B}$	$D3 : R\cancel{G}$
$V4$	$V3$	$D4 : G$	$D3 : R\cancel{G}$
$V2$	$V1$	$D2 : \cancel{G}B$	$D1 : \cancel{R}G\cancel{B}$
$V3$	$V1$	$D3 : R\cancel{G}$	$D1 : \cancel{R}G\cancel{B}$

Each domain is actually left with only one letter after doing the arc consistency check, meaning there is only one possible solution for this problem: $\{V1 : G, V2 : B, V3 : R, V4 : G\}$