Theory Homework 1

Qn 1: Standard Search Problems VS Constraint Satisfaction Problems

Differences

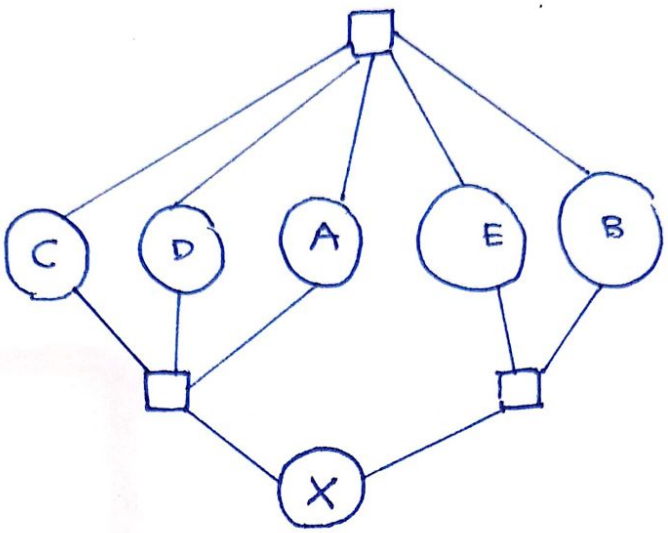
- CSP can be formulated as a standard search, but a standard search cannot be formulated as a CSP
- Standard search problems aim to find the optimal path to the goal state, but a CSP problem is only concerned about the goal state itself
- In a standard search problem, each path has various costs and depths, but for a CSP, all paths have the same cost and depth

Similarities

- Both CSP and standard search problems are formulated by state
- Both CSP and standard search problem have a goal state to be attained

Qn 2: Cryptarithmetic Problem
Variables : A, B, C, D, E, X
Domains: {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
Constraints:

1. B + B = 10.X + E
2. A + A + X = 10.C + D
3. allDiff(A, B, C, D, E)



Q3: Pure backtracking

V1: R
V2: G
V3: R
V3: G
V4: G

V2: B
V3: R
V3: G
V4: G

V1: G
V2: G
V2: B
V3: R
V4: G

Solution: V1: G, V2: B, V3: R, V4: G

Question 4:
Start: V1: {R, G, B}, V2: {G, B} V3: {R, G}, V4: {G}

V1: R -----> V1 = R, V2: {G, B}, V3: {G}, V4: {G}
V2: G -----> V1 = R, V2 = G, V3: {G}, V4: {}
V2: B -----> V1 = R, V2 = B, V3: {G}, V4: {G}
V3: G -----> V1 = R, V2 = B V3 = G V4: {}
V1: G -----> V1 = G, V2 = {B}, V3: {R}, V4: {G}
V2: B -----> V1 = G, V2 = B, V3: {R}, V4: {G}
V3: R -----> V1 = G, V2 = B, V3 = R, V4: {G}
V4: G -----> V1 = G, V2 = B, V3 = R, V4 = G

Question 5:

Queue - highlighted means final value reached, as only 1 value remains
V1 --> V2: D1=RGB, D2=GB
V4 --> V2: D4=G , D2= B~~G~~
(since 2 was updated, add all nodes dependent on 2 to button of queue)

V1 --> V3: D1=RGB , D3=RG
V3 --> V4: D3=R~~G~~ , D4=G
(since 3 was updated, add all nodes dependent on 3 to bottom of queue)

V1 --> V2: D1=RG~~B~~ , D2=B
(since 1 was updated, add all nodes dependent on 1 to bottom of queue)
V4 --> V2: D4=G , D2=B

V1 --> V3: D1= ~~R~~G , D3=R
(since 1 was updated, add all nodes dependent on 1 to bottom of queue)
V3 --> V4: D3=R , D4=G

V1 --> V2: D1=~~R~~G , D2=B
V1 --> V3: D1=~~R~~G , D3=R

V1 --> V2: D1=~~R~~G , D2=B
V1 --> V3: D1=~~R~~G , D3=R

All values now arc consistent

Therefore, the solution is, D1: G, D2: B, D3: R, D4: G