

Fall 2021: CS-415 – Artificial Intelligence

Project

SOLUTION

(25 Points) CSPs

YCPS@GIFT is going to arrange a gaming competition at campus. They are considering using seven games for this competition:

- 1) Supreme Commander (SC)
- 2) Grand Theft Auto (GTA)
- 3) Call of Duty: Modern Warfare (CoD)
- 4) Mortal Kombat (MK)
- 5) Tactical Ops (TO)
- 6) Rocket League (RL)
- 7) Dark Souls (DS)

YCPS President has assigned seven YCPS members to supervise the competition. They are:

- a) Baber
- b) Daud
- c) Faisal
- d) Jameela
- e) Kiran
- f) Marium
- g) Naila

These members can also work together, but it turns out there are various constraints as given below that they must follow:

- 1) Daud will not supervise the game in which Jameela is already assigned
- 2) Kiran must supervise either SC, GTA, or CoD
- 3) Marium can only supervise any one of games DS, CoD, or TO
- 4) Naila can supervise a game that comes before Marium's game in the list
- 5) Kiran can supervise a game that comes before Daud's game in the list
- 6) Baber can only supervise the game RL
- 7) Jameela can supervise a game that comes after Naila's game in the list
- 8) Baber cannot supervise a game with Naila
- 9) Naila cannot supervise the game RL
- 10) Faisal cannot supervise any of the games MK, TO, or RL
- 11) Daud cannot supervise the game TO
- 12) Daud must supervise a game that comes before Faisal's game in the list

This problem can be modeled as a CSP, with the **name of each YCPS member as a variable**, and the **domains are the game names**.

- a) [3]: What would be left in each variable's domain if we apply the unary constraints on each variable?

You should write your answer as: variable name: domain value(s)

Baber					TO		
Daud	SC	GTA	CoD	MK		RL	DS
Faisal	SC	GTA	CoD				
Jameela	SC	GTA	CoD	MK	TO	RL	DS
Kiran	SC	GTA	CoD				
Marium	SC		CoD		TO		
Naila	SC	GTA	CoD	MK	TO		

- b) [3]: If the MRV (Minimum Remaining Values) heuristic is applied, what variable would be assigned first?

Baber – because he has the least values left in his domain.

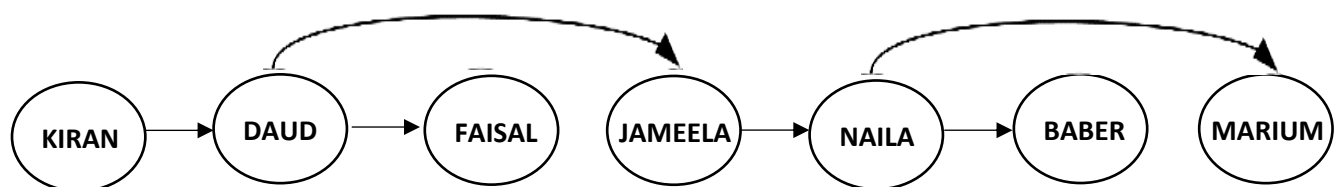
- c) [5]: Now we will use the LCV (Least Constraining Value) heuristic to assign values. We will select Marium as the first variable to be assigned. We begin by using the Forward Checking with the LCV heuristic to find the remaining values in each variable's domain. What would be the order of assigned variables using the LCV heuristic? You will need to completely show your work in which you clearly show the result of Forward Checking with LCV on each variable's domain.

Marium's value will be assigned as TO, CoD, SC, in that order.

Why these variables? They are the only feasible variables for Marium. Why this order? This is the increasing order of the number of constraints on each variable.

The only binary constraint involving Marium is "Naila must supervise a game that comes before Marium's game" So, only Naila's domain is affected by forward checking on these assignments, and it will change from {SC, GTA, CoD, MK, TO} to {SC, GTA, CoD, MK}, { SC, GTA}, and {} for the assignments TO, CoD, SC, respectively.

Suppose you are now given the following tree structured graph of this CSP as below:



[5]: Now perform a Right-to-Left pass to prune the values from each variable's domain. Write the remaining values in each variable's domain after this pass.

Remaining values in each domain after the domain pruning right-to-left pass:

Kiran: SC

Daud: SC, GTA

Faisal: SC, GTA, CoD

Jameela: GTA, CoD, MK, TO, RL, DS

Naila: SC, GTA, CoD, MK

Baber: TO

Marium: SC, CoD, TO

d) [4]: Now perform a Left-to-Right pass and assign values to each variable as a possible solution.

Assigned Values after the left-to-right pass:

Kiran: SC

Daud: GTA

Faisal: CoD

Jameela: RL

Naila: MK

Baber: TO

Marium: TO