Problem Solving Homework 2

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Fundamentals in Artificial Intelligence.

Statement of problem:

1. Analyzing non-zero-sum games
2. Each player has Distinct Utility Function
3. Both Utility Function are known by each player
4. No constraints on terminal utilities (one player doesn't have to win)
5. For any state S in all possible state's abs(utility1(S) – utility2(S)) <=k(constant)
6. Utility1(S)=u1 and utility2(S)=u2

Questions

(i) Describe minimax

In this scenario minimax will choose the maximum of the m maximum of both functions when maximizing, this is. max (max(u1, u2)).

Abs(u1-u2) <=k So each player when maximizing chooses the maximum of the maximum (u1, u2) as maximizes their gains as per the utility. If they were to choose the minimum instead, then the opponent can capitalize on the minimizing using the better functions. There is a risk of gain of abs(max(u1)-max ()) to the party maximizing and a chance of loss of abs(u1-u2) to the party minimizing. Either way the maximizing party stands to gain rather than to lose based on the opponent's decision

Let's consider the tree below where the evaluation of both functions is presented

0 (max)

4,1 3,7 (Min)

If player1 were to play with their utility function alone then they would choose (4) from (4, 3) as its in their best interest and it maximize their gains and minimizes their opponents.

4 (max)

4 3 (min)

if player 2 was evaluating this play on behalf of player 1 then they would choose 7 as it is maximizing resulting in a calculated loss of 3 utilities in comparison with u1

7 (max)

1 7 (min)

Subsequently if each player has access to both utility values it would be in the best interest of either play to choose the maximum of the two functions this result in the tree. At the min level of the utility functions if they didn't choose the minimum of both functions, the difference in utilities would be at its largest. Causing large losses for both parties at random intervals. By utilizing both utilities the calculated loss of both parties is somewhat normalized

(1,3) (max1,max2) => 3

4,1 3,7 (min1, min2) => 1 3

(ii) Describe alpha beta pruning

Alpha beta pruning can be done on the differences of the utility where the maximum gain will be calculated as the minimum differences of abs(u1-u2). The smaller the difference the closer they are together. Which minimizes the loss of both players. The same goes for the minimizing level the differences of the abs(u1-u2) will need to minimized creating an almost balanced evaluation as the utility approaches the root

Question 2

R&N Problem 6.8: (8 points) Consider the graph with 8 nodes A1,A2,A3,A4,H,T,F1,F2 . Ai is connected to Ai+1 for all I, each Ai is connected to H, H is connected to T, and T is connected to each Fi . Find a 3-coloring of this graph by hand using the following strategy: backtracking with conflict-directed backjumping, the variable order A1,H,A4,F1,A2,F2,A3,T , and the value order R, G,B.

Please see file Fundamentals **of Artificial Intelligence Question 2_Justino_DaSilva.pdf** that accompany this report

3. Question 3 Course scheduling

You are in charge of scheduling Computer Science classes that meet Mondays, Wednesdays and Fridays. There are 5 classes that meet on these days and 3 professors who will be teaching these classes. You are constrained by the fact that each professor can only teach one class at a time.

The classes are:

1. Class 1 - Intro to Programming: meets from 8:00-9:00am
2. Class 2 - Intro to Artificial Intelligence: meets from 8:30-9:30am
3. Class 3 - Natural Language Processing: meets from 9:00-10:00am
4. Class 4 - Computer Vision: meets from 9:00-10:00am
5. Class 5 - Machine Learning: meets from 10:30-11:30am

The professors are:

1. Professor A, who is qualified to teach Classes 1, 2, and 5.
2. Professor B, who is qualified to teach Classes 3, 4, and 5.
3. Professor C, who is qualified to teach Classes 1, 3, and 4.

Task:

Formulate this problem as a CSP problem in which there is one variable per class, stating the domains (after enforcing unary constraints), and binary constraints. Constraints should be specified formally and precisely but may be implicit rather than explicit.

Answer Corresponding CSP problem

Constraints

1. Class 1 can be thought of by professor A or C
2. Calss 2 can only be thought by professor A
3. Class 3 and 4 can be thought of by professor B or C
4. Class 5 can be thought of by professor A or B

Color sequence to represent graph is Professors(A,B,C)=Color(Red,Green,Blue) respectively

Domains:

Class	**Domains**
Class 1	Red, Blue
Class 2	red
Class 3,4	Green, Blue
Calss 5	Red and Green

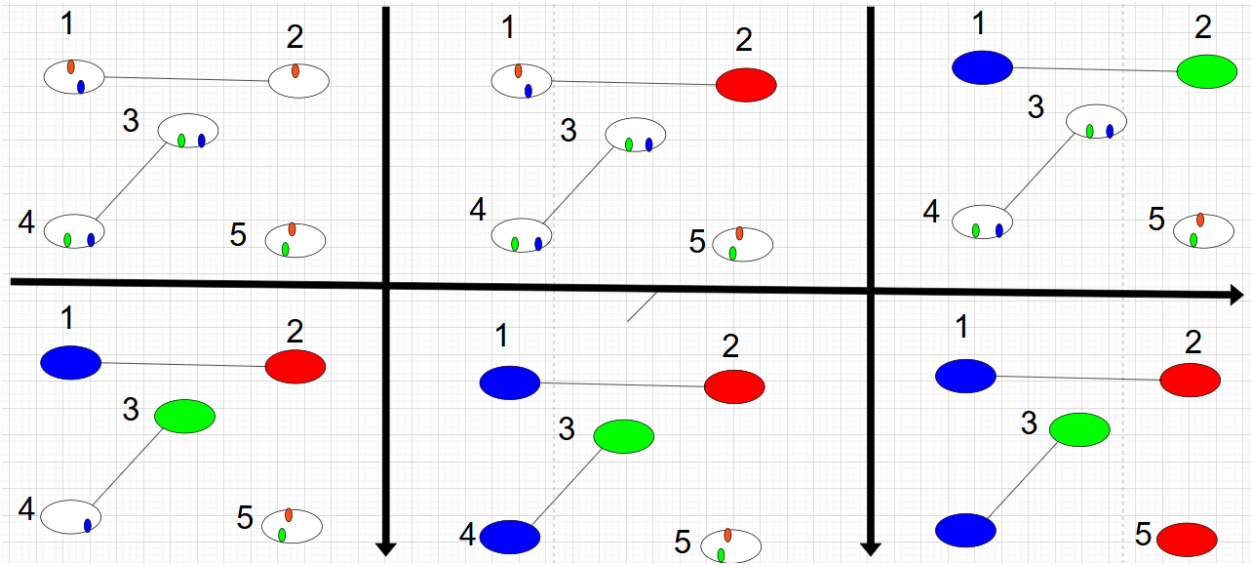
Creating the graph.

a. **Color Choosing:** If a professor teaches a subject to corresponding color is added to the vertex as a possible choice

b. Arc: and arc is created between vertex i to vertex j if a professor teaches both subjects. According to this definition two arcs were identified.

Scheduling:

Coloring sequence = (Red, Green,Blue), starting with the vertex with the least option



Completed Schedule

Time Course	8:00	8:30	9:00	9:30	10:00	10:30	11:00	11:30
1. Intro to Programming	C	C	C					
2. Intro to artificial Intelligence		A	A	A				
3. Natural Language Processing			B	B	B			
4. Compute Vision			C	C	C			
5. Machine Learning						A	A	A