



Artificial Intelligence

Assignment 2

Assignment due by: 08.11.2017, Discussion: 10.11.2017

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Question 1 Rationality (6 points)

Suggestion: Draw probability tree diagrams.

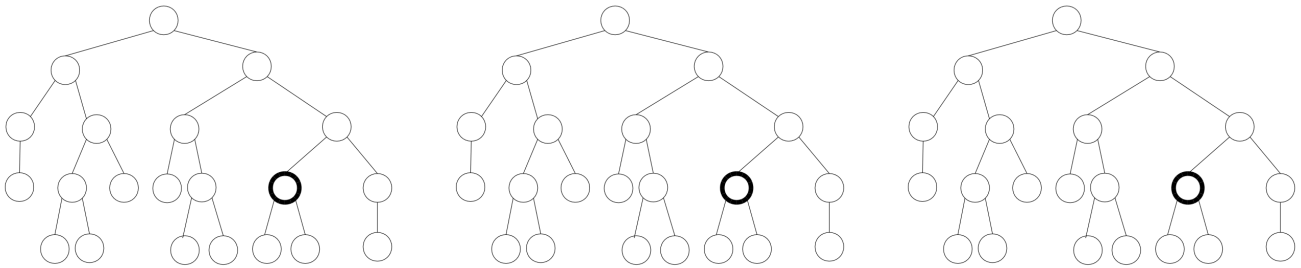
- (a) One of your friend challenges you to a game with a pair of dice with the following rules: should one of the dice be a six he gives you 6 euros, should both dice be sixes he gives you 16 euros, however, should the dice be anything else you owe him 4 euros. Is it in your interest to play this game only once (i.e. one round) (1 point)? Is it in your interest to play it twice (i.e. two rounds) (1 point)? What is your average expected income per round in this game (1 point)? Please justify each answer.
- (b) Two members of a criminal gang are arrested and imprisoned. Each prisoner is in solitary confinement with no means of communicating with the other. The prosecutors lack sufficient evidence to convict the pair on the principal charge. They hope to get both sentenced to a year in prison on a lesser charge. Simultaneously, the prosecutors offer each prisoner a bargain. Each prisoner is given the opportunity either to: betray the other by testifying that the other committed the crime, or to cooperate with the other by remaining silent. Both cannot communicate, they are separated in two individual rooms. The offer is:
- If A and B each betray the other, each of them serves 3 years in prison
 - If A betrays B but B remains silent, A will be set free and B will serve 5 years in prison (and vice versa)
 - If A and B both remain silent, both of them will only serve 6 months in prison (on the lesser charge)

Assuming that both prisoners act as individual rational agents, and that despite being members of the same gang, they have no loyalty to each other (i.e. non-cooperative agents), please specify the outcome for both prisoners. Justify your answer. (3 points)

Question 2 Search strategies (1+1+2 = 4 points)

Enumerate the nodes (as many times as they are visited) depending on the search algorithm. The bold node is the goal node, the search should stop once the goal node is reached.

- (a) Breadth-first search
- (b) Depth-first search
- (c) Iterative deepening depth-first search



Question 3 Programming in LISP (2+3+3+2 = 10 points)

When doing these exercises you are **not** allowed to use either looping constructs or built in functions that solve the exercise by themselves.

- (a) Implement a function (`addSort a b`) that adds lists *a* and *b* element-wise, sorts the results and removes duplicates.

Example: From the lists *a* = '(1 3 8 7 2 2) and *b* = '(7 2 1 4 0 3) the function should return '(2 5 8 9 11).

- (b) Implement a function (`searchTree a tree`) that looks for the value *a* in a binary tree *tree*. The function should return how deep *a* is in the binary tree i.e. in which level is *a* located. If *a* does not exist in the tree, the solution should be *nil*. Each node of the binary tree is represented as a list. The list is composed of (i) the node element (scalar value), (ii) a list representing the left child and (iii) a second list representing the right child. The absence of a child is expressed as *nil*.

Example: '(2 (4 nil nil) (7 nil nil)) represents a binary tree with the element 2 as root with children 4 and 7.

- (c) Implement a function (`deleteTree a tr`), which deletes any instance of *a* from a binary tree *tr*. The function should return the new binary tree. If *a* is not found in the tree, the initial binary tree should be returned. The structure of the tree is the same as in task b.
- (d) Implement a function (`mapFilter a f`), where *a* is a list and *f* a function. `mapFilter` should return the values of *a* in which *f* is not *nil*.

```
> (mapFilter '(1 2 5 15 24 13 14)
      (lambda (x)
        (if (evenp x) (1+ x) nil)))
> (3 25 15)
```