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Assignment 1

Minsoo Park

Q: What is the standard Turing Test? How would you design and improve it for testing true human intelligence? How would you design a "new Turing Test" for consciousness and creativity, respectively?

It is a test of method which AI (computer) can think like a human being or not. There are A and B player which one is a computer and other is a human. Pick any random person to interrogator C and give tasks to determine which player is a computer and which is a human.

However, there are some limitations form this method. For improving these things, we can test with many interrogators and test players, not only three samples which means it can be A, B, C, D... and more. Also, we can do to reduce the variables, making steps of A and B only be answered to yes or no.

Give machine or computer to learn about paintings and painters' styles. Then bring the real painters and make both to draw new paintings. After that, bring those two paintings to the public and ask them to which painting is looks like drawn by person. So, it will help us to understand machine's consciousness and creativity.

Q: Can a reflex agent be rational (maximizing the expected utility function) in solving complex problems? Give some examples that it can, and some examples that it cannot.

It is good at simple environment such as determining by memory and instinct. For example, it is rational when we are playing Pac-man, if our goal is just eating food in one way map, we can get optimal behaviour without any simulating. However, if the map is being more complexed and now goal is finding minimum way to reach it doesn't be rational anymore. We should think "what if" and simulate what is future if we move this way. The other example can be cleaning the house, when we just clean the house normally, we can just do it same as our previous memory and action. However, if we are going to clean friend house with limit time, we should plan and think the things to do which means what is best way to right order.

Q 3.8 Give a complete problem formulation for each of the following. Choose a formulation that is precise enough to be implemented.

a. Using only four colors, you have to color a planar map in such a way that no two adjacent regions have the same color.

Initial state: No regions colored.

Successor function (action and cost): Assign a colour to an uncoloured region but can't assign the previously adjacent regions which have the same colour.

Cost = number of coulured regions

Goal test: All regions are coloured, adjacent regions doesn't have the same colour.

b. A 3-foot-tall monkey is in a room where some bananas are suspended from the 8-footceiling. He would like to get the bananas. The room contains two stackable, movable, climbable 3-foot-high crates.

Initial State. A 3-foot-tall monkey is in a room with an 8-foot ceiling and there are bananas suspended somewhere and two 3-foot-high crates.

Successor function (action and cost): A monkey can move to any direction, move a crate, stack a crate, climb a crate, and grab a bananas

Cost = number of moves or actions of monkey.

Goal Test: The monkey grabs bananas.

c. You have a program that outputs the message "illegal input record" when fed a certain file of input records. You know that processing of each record is independent of the other records. You want to discover what record is illegal.

Initial state: all input records.

Successor function (action and cost): input the independent record

Cost = number of runs

Goal test: get the illegal record with message "illegal input record."

d. You have three jugs, measuring 12 gallons, 8 gallons, and 3 gallons, and a water faucet. You can fill the jugs up or empty them out from one to another or onto the ground. You need to measure out exactly one gallon.

Initial state: three empty jugs which sizes are 12, 8, and 3 gallons.

Successor function (action and cost): fill up the jug with water, move water from jug to other jug, spill water out to ground

Cost = number of actions

Goal test: the water from the jug is one gallon.

Q 3.14 Which of the following are true and which are false? Explain your answers.

a. Depth-first search always expands at least as many nodes as A* search with an admissible heuristic.

False

Depth-first search can have less node than A* search when the solution is left-most.

b. h(n) = 0 is an admissible heuristic for the 8-puzzle.

True

By the formula $0 \leq h(n) \leq h*(n)$, estimated value can be greater or equal than 0 and always smaller and equal than actual value. Therefore, it is admissible.

c. A∗ is of no use in robotics because percepts, states, and actions are continuous.

False

The robotics still can be discrete states with continuous statement.

d. Breadth-first search is complete even if zero step costs are allowed.

True

Breadth-first search does not find least-cost path which means does not care cost, so it is complete when there is finite depth.

e. Assume that a rook can move on a chessboard any number of squares in a straight line, vertically or horizontally but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves.

False

The Manhattan distance can be over-estimated than actual value (h*) because rook can across several square by one move.

Q 3.21 Prove each of the following statements, or give a counterexample:

a. Breadth-first search is a special case of uniform-cost search.

True

If all costs are equal on uniform-cost search, it is same as breadth-first search

b. Depth-first search is a special case of best-first tree search.

False

Both DFS and BFS are special case of Uniform-cost search. It does not care the cost, so it does not relate with best-first tree search.

c. Uniform-cost search is a special case of A∗ search.

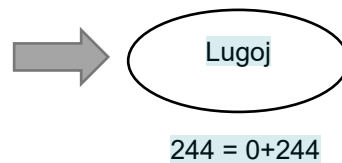True

Uniform cost search's fringe is (node, uniform cost)

A* fringe is (node, uniform cost + h(n))

Therefore, uniform cost search is same as when A* search has h(n) = 0

Q. 3.23 Trace the operation of A∗ search applied to the problem of getting to Bucharest from Lugoj using the straight-line distance heuristic. That is, show the sequence of nodes that the algorithm will consider and the f, g, and h score for each node.
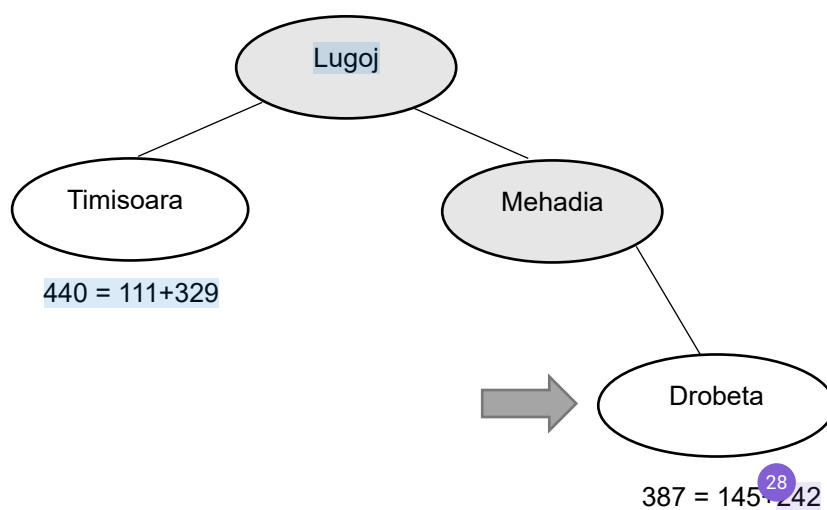
A* function: f(n) = g(n) + h(n)

a. The initial state
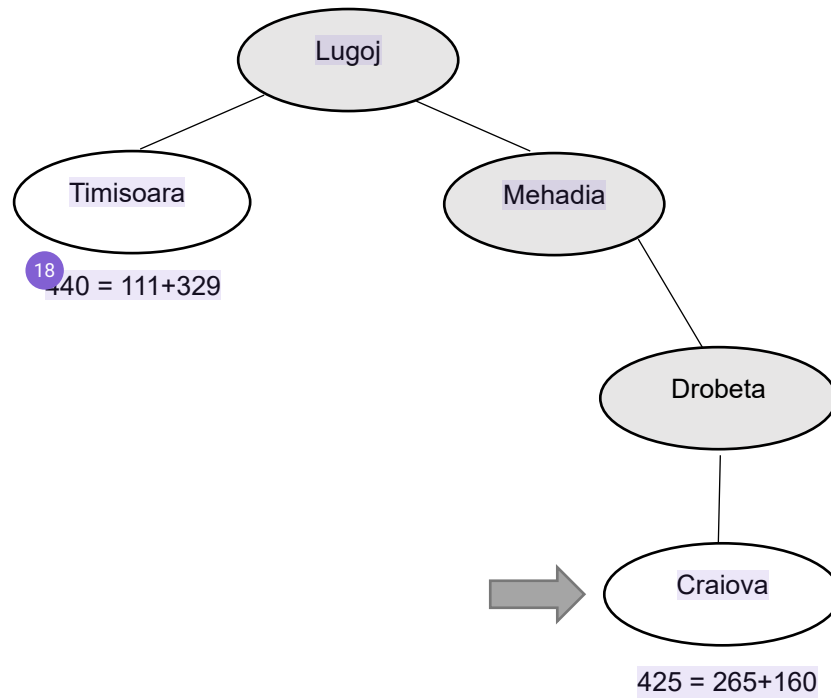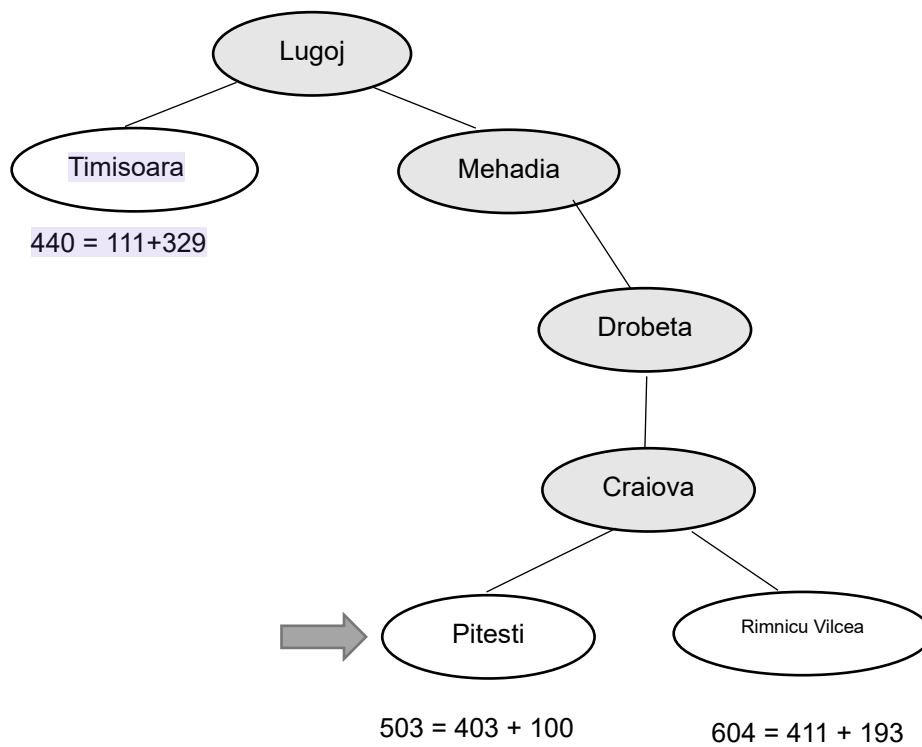

244 = 0+244

b. After expanding Lugoj

440 = 111+329   311 = 70+241
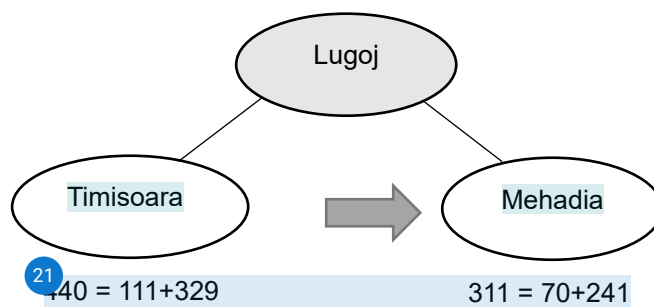
c. After expanding Mehadia

440 = 111+329

387 = 145+242

d.

e. After expanding Drobeta

```
                        Lugoj
                       /      \
              Timisoara        Mehadia
              440 = 111+329          \
                                    Drobeta
                                        \
                           →         Craiova
                                    425 = 265+160
```

f. After expanding Craiova

```
                    Lugoj
                   /      \
          Timisoara        Mehadia
          440 = 111+329          \
                               Drobeta
                                    \
                                 Craiova
                                 /      \
                    →      Pitesti        Rimnicu Vilcea
                      503 = 403 + 100      604 = 411 + 193
```
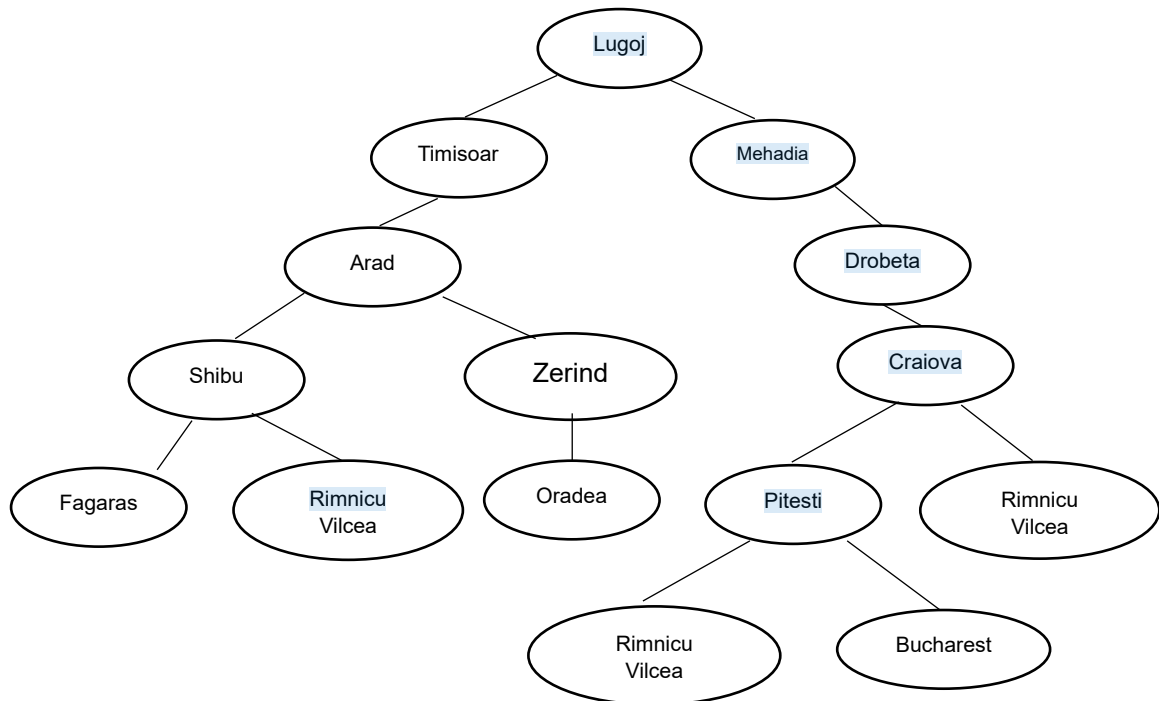
g. [24] After expanding Pitesti
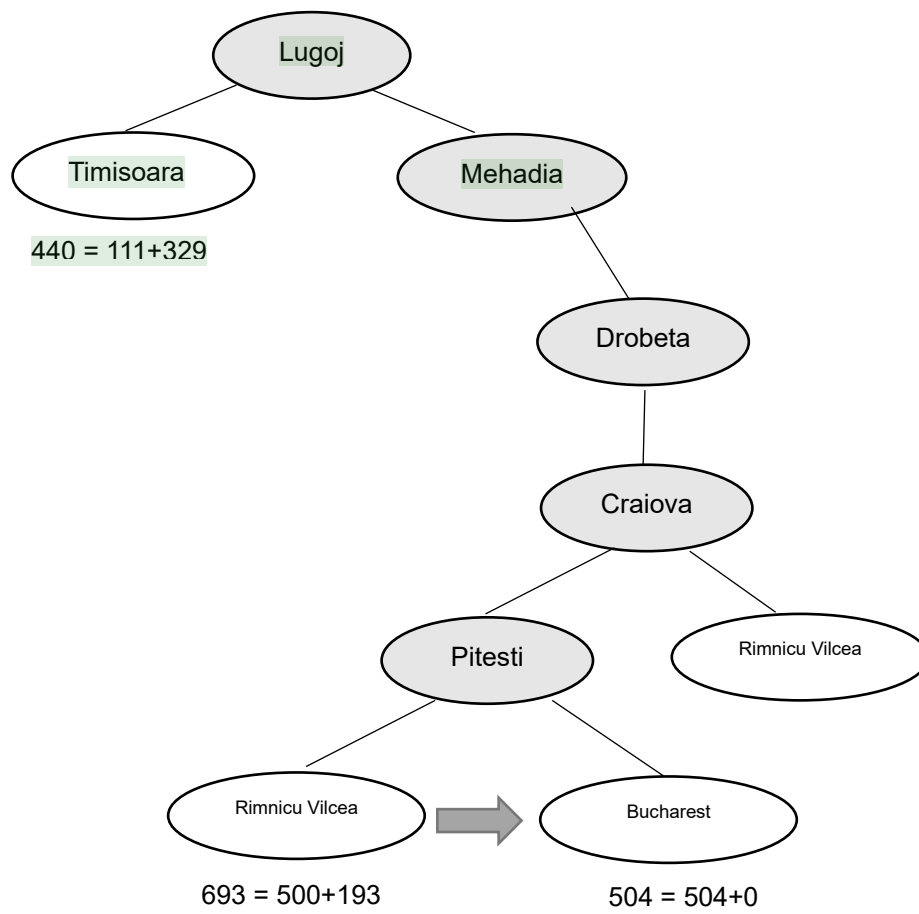
Q. 3.23, but apply the DFS and BFS, and show how the Fringe is updated for the first 4 nodes searched (when the node is taken out of Fringe).

    a. DFS (using drawn diagram)

Fringe:

Lugoj

Timisoara, Mehadia

Arad, Mehadia

Shibu, Zerind, Mehadia

Fagara, Rimnicu Vilcea, Zerind, Mehadia

And more…

    b. BFS

Fringe:

Lugoj

Timisoara, Mehadia

Mehadia, Arad

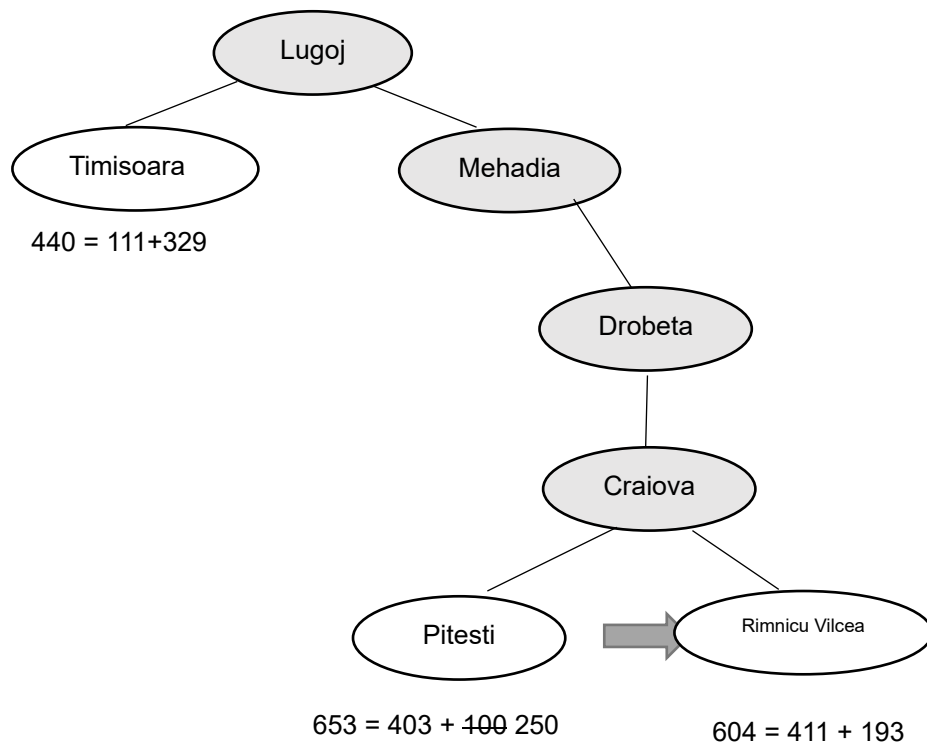Arad, Drobeta

Drobeta, Shibu, Zerind

Shibu, Zerind, Craiova

And more…

d. 3.23, but change the heuristic function values such that it is non-admissible and A* will not return the optimal solution.
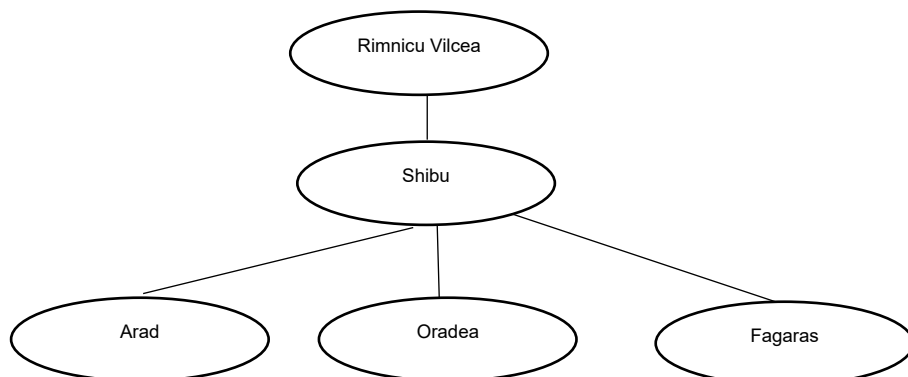
    a. If heuristic function values such that it is non-admissible On Pitesti

       Which h(n) value is 250 not 100

440 = 111+329

653 = 403 + ~~100~~ 250

604 = 411 + 193

    b. Then the A* search go through Rimnicu Vilcea and Shibu

       Which means not having optimal solution for this situation.

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