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CSCI 331 Section 1

June 16th, 2021

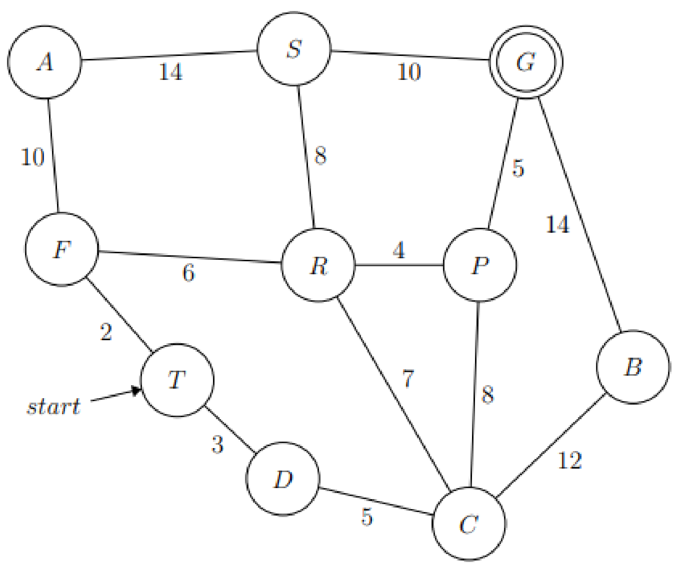
Homework 3

1) *Trace the operation of*

h_SLD : A = 20; B = 10; C = 12

D = 13; F = 25; P = 4

R = 10; S = 8; T = 22



a) *Greedy Best First Search*

Path	Node	Neighboring Nodes
-	T	F: h(F) = 25 | **D: h(D) = 13**
T	D	T: h(T) = 22 | **C: h(C) = 12**
T, D	C	D: h(D) = 13 | R: h(R) = 10 | **P: h(P) = 4** | B: h(B) = 10
T, D, C	P	**G: h(G) = 0** | R: h(R) = 10 | C: h(C) = 12

Chosen Path: T, D, C, P, G

b) *A* to the problem of getting from node T to node G below using the heuristic of straight-line distance. Show the sequence of nodes that the algorithms will consider and the f, g, and h values for each node. For paths that would result in loops, only show the repeated node, do not expand its children.*

Path	**Node**	**Neighboring Nodes**
-	T	F: h(F) = 25; g(F) = 2; f(F) = 27 **D: h(D) = 13; g(D) = 3; f(D) = 16**
T	D	T: h(T) = 22; g(T) = 6; f(T) = 28 **C: h(C) = 12; g(C) = 8; f(C) = 20**
T, D	C	D: h(D) = 13; g(D) = 13; f(D) = 26 R: h(R) = 10; g(R) = 15; f(R) = 25 **P: h(P) = 4; g(P) = 16; f(P) = 20** B: h(B) = 10; g(B) = 20; f(B) = 30
T, D, C	P	**G: h(G) = 0; g(G) = 21; f(G) = 21** R: h(R) = 10; g(R) = 20; f(R) = 30 C: h(C) = 12; g(C) = 24; f(C) = 36

Chosen Path: T, D, C, P, G

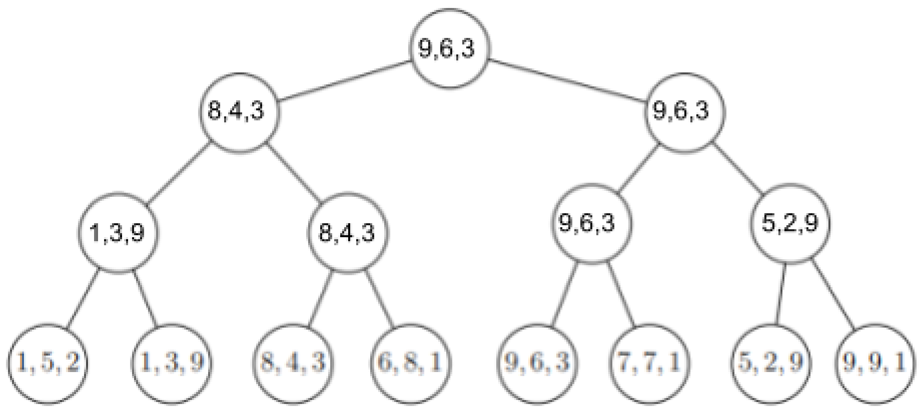
c) *You may have noted that A* seems to return a sub-optimal path. Why is that?*

A* returns a suboptimal path because the heuristic is too heavily considered. The most optimal path would be T, F, R, P, G. There are cases in which h(n) of one neighboring node is significantly larger than the other which then causes f(n) of each neighboring node to be incorrect. For example, if we start from node T. The neighboring nodes are node F and node D; h(F) = 25 and h(D) = 13 while g(F) = 2 and g(D) = 3. This algorithm would choose node D even though node F has the lower cost to get to the goal.

2) *Describe Hill-climbing search. What are some of its limitations?*

The Hill-climbing search traverses through the nodes and uses a heuristic in order to choose a path closer to achieving its goal. Some limitations include not being able to undo a move once you go down a path, always choosing the closer node even if a further away node would closer achieve the goal, and that you can be stuck at local maxima.

3) *Look at Figure 5.4 on Page 166 of the R&N book*



a) *Fill in the above 3 player minimax search tree.*

b) *If you had encountered a tie in one of the comparisons for part (a), explain a reasonable approach for dealing with this.*

If you had encountered a tie, a reasonable approach is to set a rule that must always be followed. A player would choose the option that would have the lowest total of the other points. For example, if player A had to choose between (2, 9, 9) and (2,1,1), they would choose (2,1,1) because it would give the other players a minimal value. If we also consider a case like (3, 4, 5) and (3, 5, 4) in which the other points add up equally, player A can choose the smaller second number for player B.

4) *Create and fill in a Minimax search tree for a 9 token game of Nim. Assume that MAX makes the first move. Fill in the utility value for each node generated.*

Each node has a utility of 1 if its border is solid and 0 if its border is dashed. Rows 1, 3, 5, 7 are MAX, and Rows 2, 4, 6, 8 are MIN.