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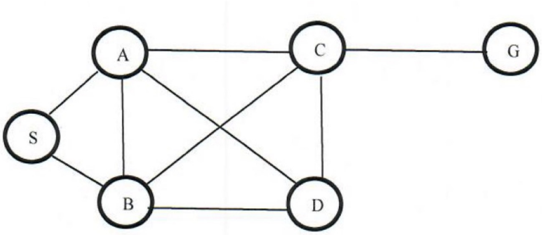
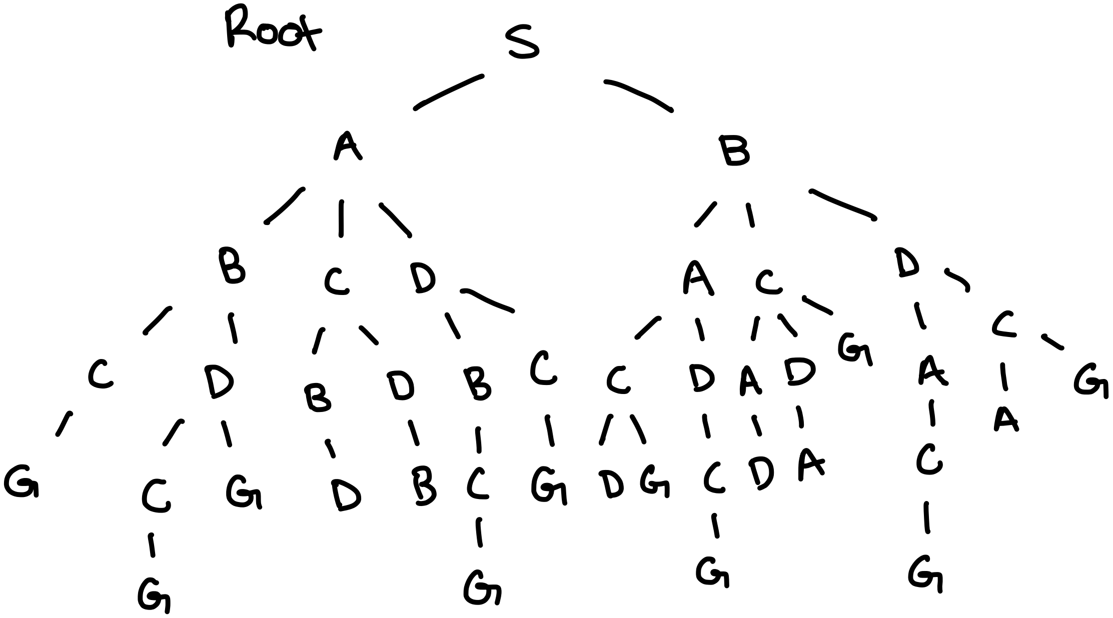
CS 4365.002

# Homework 1

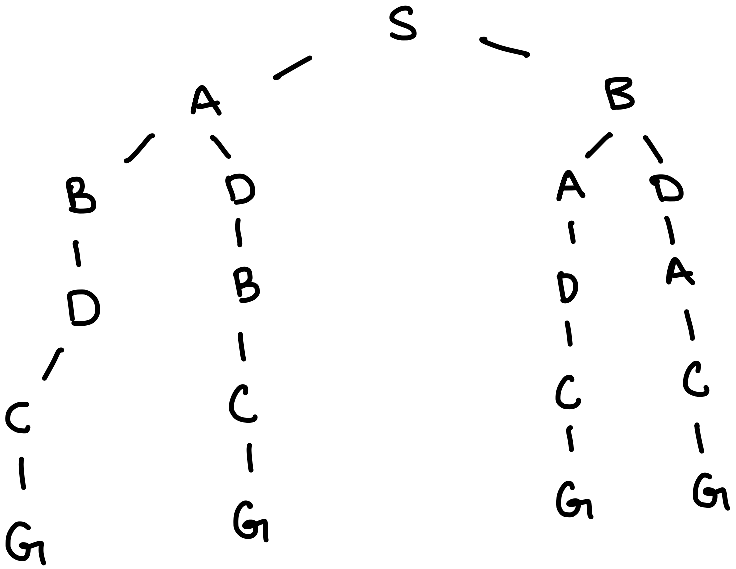
1. Draw the tree of all loop-free paths that is equivalent to the net shown below. When a node has more than one child, arrange them in alphabetical order.

(10 Points)





Path that reaches all nodes



2. Uninformed Search

(20 points)

We define a state space as follows. The start state is 1. The successor function for state n returns two states, which are numbered 2n and 2n + 1. The goal state is 13. Answer the following questions: ( *4 Points each*)

a) Draw the state space involving only states 1 to 13.

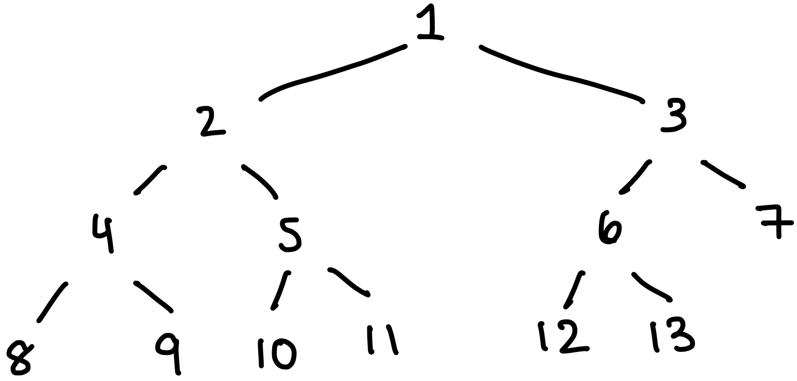
b) List the order in which nodes will be visited for breadth first search.

c) List the order in which the nodes will be visited for depth-limited search with limit 3.

d) List the order in which the nodes will be visited for iterative deepening search.

e) Is bidirectional search appropriate for this problem? Explain your answer.

a)



b) BFS

[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13]

c) DFS with limit 3

[ 1, 2, 4, 8, 9, 5, 10, 11, 3, 6, 12, 13]

d) Iterative Deepening Search

Depth (0)

[1]

Depth (1)

[1, 2, 3]

Depth (2)

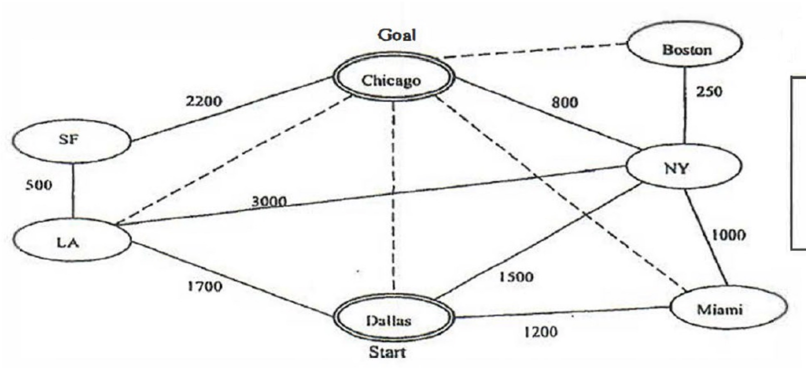
[1, 2, 4, 5, 3, 6, 7]

Depth (3)

[1, 2, 4, 8, 9, 5, 10, 11, 3, 6, 12, 13]

e) Bidirectional search could work for this problem since bidirectional search would reduce the time complexity from $O(b^d)$ to $O(b^{d/2})$. It works because this is a graph without a cycle and could go from start to finish.

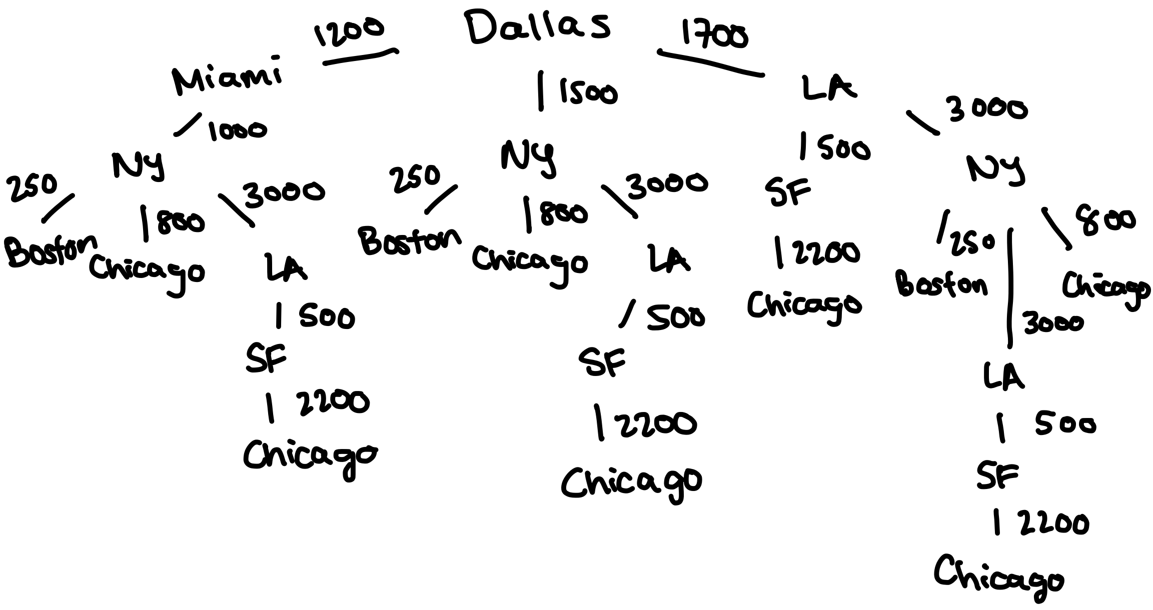
3. This is a highway map with cities and distances between them. The continuous lines indicate highway connections between cities, and dotted lines are direct distances.



| Direct Distances from Chicago | |
|---|---|
| Miami | 2000 |
| NYC | 800 |
| Boston | 900 |
| Dallas | 1200 |
| SF | 2200 |
| LA | 2400 |

a) Provide a search tree. Dallas is the start point, and Chicago is the goal destination.

(10 Points)



b) Using A * Search algorithm, find a path from Dallas to Chicago. Show all steps for full credit. (10 Points)

$f(n) = g(n) + h(n)$

$n =$ node

$g(n) =$ path to $n$

$h(n) =$ heuristic / path from $n$ to target

At Dallas:

$f(\text{Miami}) = 1200 + 2000 = 3200$

$f(\text{NY}) = 1500 + 800 = 2300$ ☆

$f(\text{LA}) = 1700 + 2400 = 4100$

At NY:

$f(\text{Boston}) = (250 + 2300) + 900 = 3450$

$f(\text{Chicago}) = (800 + 2300) = 3100$ ☆

$f(\text{LA}) = (3000 + 2300) + 2400 = 7700$

$f(\text{Miami}) = (1000 + 2300) + 2000 = 5300$

Path is Dallas → NYC → Chicago

Total cost = 3100