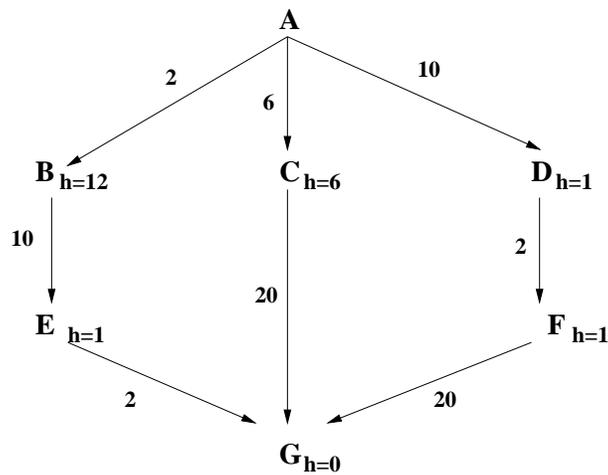


1st Midterm Exam
Tuesday February 24
75 minutes == 75 points
open book and notes

1. *15 points*

You are given the following graph, where each node has an identifier (a letter) and an h value. A number along an arc indicates the cost of the arc.



1. Show in what order A* expands nodes from Start to G. G is the goal node. For each node expanded during the search show its f and g values. If a node is reached on multiple paths show its f and g values each time the node is reached, and indicate its parent node.
2. What is the solution path found?
3. Is the h function admissible? is it consistent? Justify your answer.

2. *15 points*

Suppose you decide to do best-first search using the following evaluation function $f(n) = (1 - w)g(n) + wh(n)$.

1. Assuming that $h(n)$ is admissible, what are the values of w that guarantee the algorithm will find an optimal solution? Justify your answer.
2. Is there a range of values of w which guarantees that the algorithm using the evaluation function f is admissible? If yes, what is the range? Justify your answer.

TURN TO THE NEXT PAGE FOR MORE QUESTIONS

3. *15 points*

Suppose you have two admissible heuristics, h_1 and h_2 . You decide to create the following new heuristic functions defined as follows:

$$h_3(n) = \max(h_1(n), h_2(n))$$

$$h_4(n) = \max(h_1(n), 1.1 * h_2(n))$$

$$h_5(n) = \min(h_1(n), 3 * h_2(n))$$

$$h_6(n) = \frac{h_1(n) + h_2(n)}{2}$$

For each of the new heuristics specify if it is admissible or not. Justify your answer. Would you use any of these heuristics instead of using h_1 or h_2 ?

4. *15 points*

Answer these questions briefly but precisely.

1. Would Hill-Climbing be appropriate for the Missionaries and Cannibals Problem? Why (or why not?).
2. Is it possible for Iterative Deepening Depth-First Search to do worse than Depth-First? Explain your reasoning.
3. Explain briefly when you would use LRTA* instead of Online-DFS.

5. *10 points*

Write a function, `remove-adj-dup`, to remove all adjacent duplicate elements in a list. It should work like this:

```
(remove-adj-duplicates '(a b b c b d d d) )  
(a b c b d)
```

6. *5 points*

Write a function, `add--numbers`, to add all the values in an association list that are numbers. It should work like this:

```
(add-all-numbers '((color red) (weight 3) (type apple) (id 120452)))  
120455
```

YOU REACHED THE END OF THE EXAM