

6.034 Quiz 2

October 22, 2008

Name	
E-Mail	

Circle your TA and recitation time, if any, so that we can more easily enter your score in our records and return your quiz to you promptly.

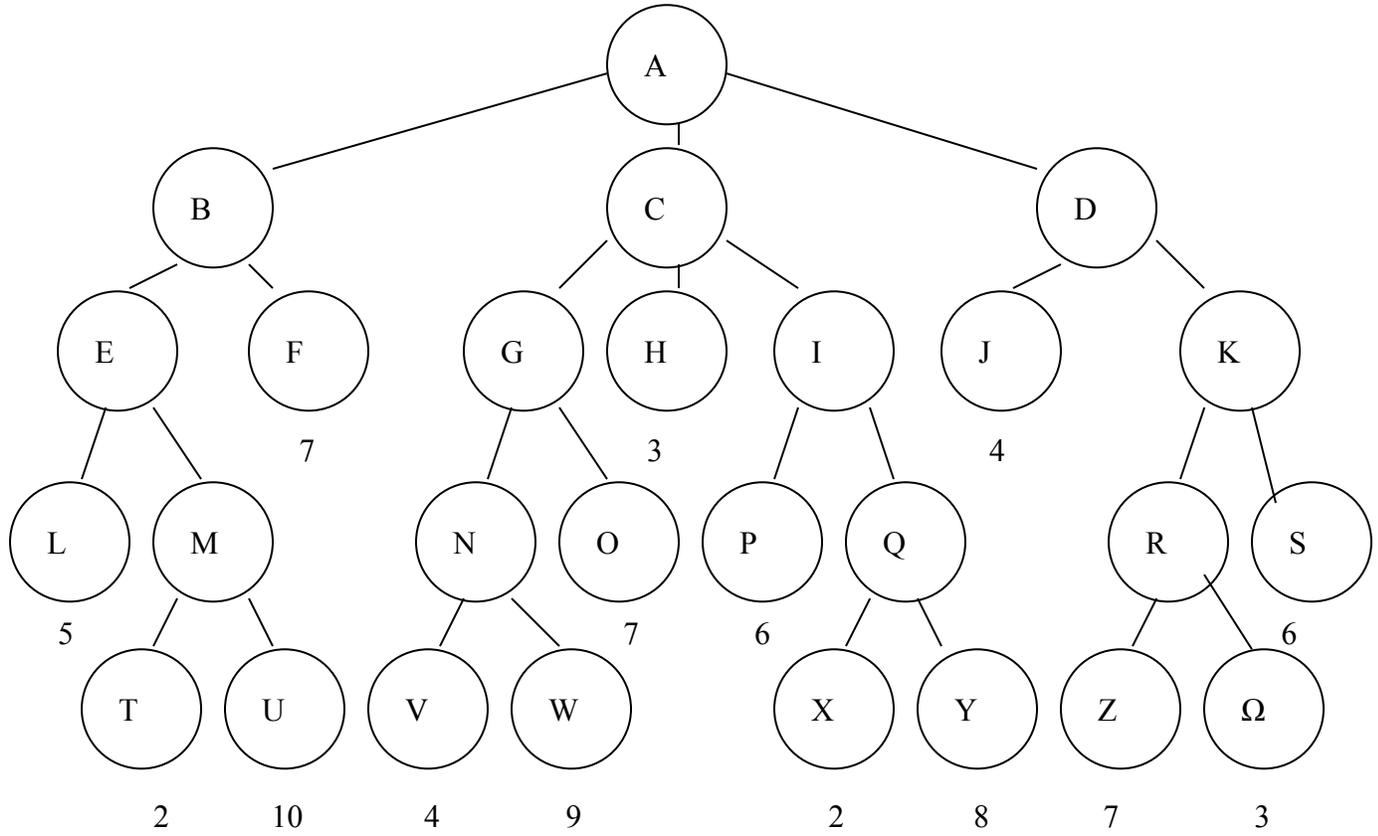
TAs	Thu	Fri
Sam Glidden	Time	Instructor
Mike Klein	1-2	Bob Berwick
Rud R. Lestier	2-3	Bob Berwick
Mark Seifert	3-4	Bob Berwick
	Time	Instructor
	1-2	Howard Shrobe
	2-3	Howard Shrobe
	3-4	Howard Shrobe

Problem number	Maximum	Score	Grader
1	50		
2	50		
Total	100		

There are 8 pages in this quiz, including this one. In addition, tear-off sheets are provided at the end with duplicate drawings and data.

As always, open book, open notes, open just about everything.

Problem 1: Games (50 points)



Your 6.034 TAs have invented a new game called Alpha Beta Cold War, and they want you to test it out. You quickly realize that nearing the end of your test game, the game tree looks like the above diagram.

Assume the **maximizer has the choice at node A**.

Part A (15 points)

- 1) Circle the move the maximizer should take at A

B	C	D
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- 2) What is the minimax value at Node A?

- 3) How many static evaluations are performed in your minimax search without alpha-beta pruning?

Part B (15 points)

Using alpha-beta pruning on the same game tree, which nodes are statically evaluated?

PART C (10 points)

Steve is thinking of writing a program for Alpha Beta Cold War and tries to remember why it is good to use progressive deepening. “I know I may pay a little bit of cost to evaluate each level progressively,” Steve reasons, “But let’s ignore that. When it comes to performing alpha-beta on the final level, I’m ***guaranteed*** to always prune at least as well or better if I rearrange the nodes based on the results of my progressive deepening, right?” Is Steve right? If so, briefly explain why you have this guarantee. If not, briefly explain why not.

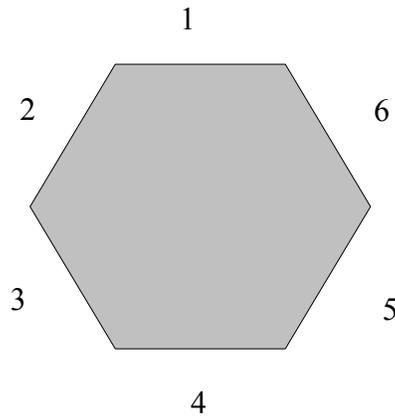
Part D (10 points)

Alex is worried about whether the 6.034 claims about minmax time really apply to program for the game. “In my program, the static values take time S to compute, and S is essentially zero. The really expensive calculation is move generation, the process that generates the b branches beneath a given node, which takes time M per node processed. For a tree of depth d and branching factor b , what is the time required for all the move generations, at every level in which moves are generated, given **no** alpha-beta or extended-list pruning:

Explain briefly:

Problem 2: Constraint Propagation (50 points)

You just bought a 6-sided table (because it looks like a benzene ring) and want to hold a dinner party. You invite your 4 best friends: McCain, Obama, Biden and Palin. Luckily a moose wanders by and also accepts your invitation. Counting yourself, you have 6 guests for seats labeled 1-6.



Your guests have seven seating demands:

- Palin wants to sit next to McCain
- Biden wants to sit next to Obama
- Neither McCain nor Palin will sit next to Obama or Biden
- Neither Obama nor Biden will sit next to McCain or Palin
- The moose is afraid to sit next to Palin
- No two people can sit in the same seat, and no one can sit in 2 seats.
- McCain insists on sitting in seat 1

Part A (10 points)

You realize there are 2 ways to represent this problem as a constraint problem. For each below, run the domain reduction algorithm and continue to propagate through domains reduced to one value. That is, **cross out all the impossible values in each domain without using any search.**

Variables: You, Moose, McCain, Palin, Obama, Biden

Domains: Seats 1-6

Constraints: I-VII

You:	1	2	3	4	5	6
Moose:	1	2	3	4	5	6
McCain:	1	2	3	4	5	6
Palin:	1	2	3	4	5	6
Obama:	1	2	3	4	5	6
Biden:	1	2	3	4	5	6

Variables: Seats 1-6

Domains: You, Moose, McCain, Palin, Obama, Biden

Constraints: I-VII

1:	You	Moose	McCain	Palin	Obama	Biden
2:	You	Moose	McCain	Palin	Obama	Biden
3:	You	Moose	McCain	Palin	Obama	Biden
4:	You	Moose	McCain	Palin	Obama	Biden
5:	You	Moose	McCain	Palin	Obama	Biden
6:	You	Moose	McCain	Palin	Obama	Biden

Part B (15 points)

For now, you decide to continue using seats as variables and guests as domains (the 2nd representation). You decide to see how a depth-first search with no constraint propagation works, but as you run the search you see you are doing a lot of backtracking.

You break ties by choosing the left-most in this order:

You (Y), Moose (M), McCain(Mc), Palin (P), Obama (O), Biden (B)

Show the partial search tree *only* up to the first time you try to **assign seat 6**.

Begin with the reduced domains from the previous

page. Use only the constraints supplied; use no commonsense beyond what you see in the constraints. You might want to work this out on the tear off sheet at the end of the quiz first.

1	
	Mc
2	Y M P
3	
4	
5	
6	

Part C (15 points)

Now you try to use depth-first search *and constraint propagation through domains reduced to size 1*. You break ties by choosing the left-most in this order:

You (Y), Moose (M), McCain(Mc), Palin (P), Obama (O), Biden (B)

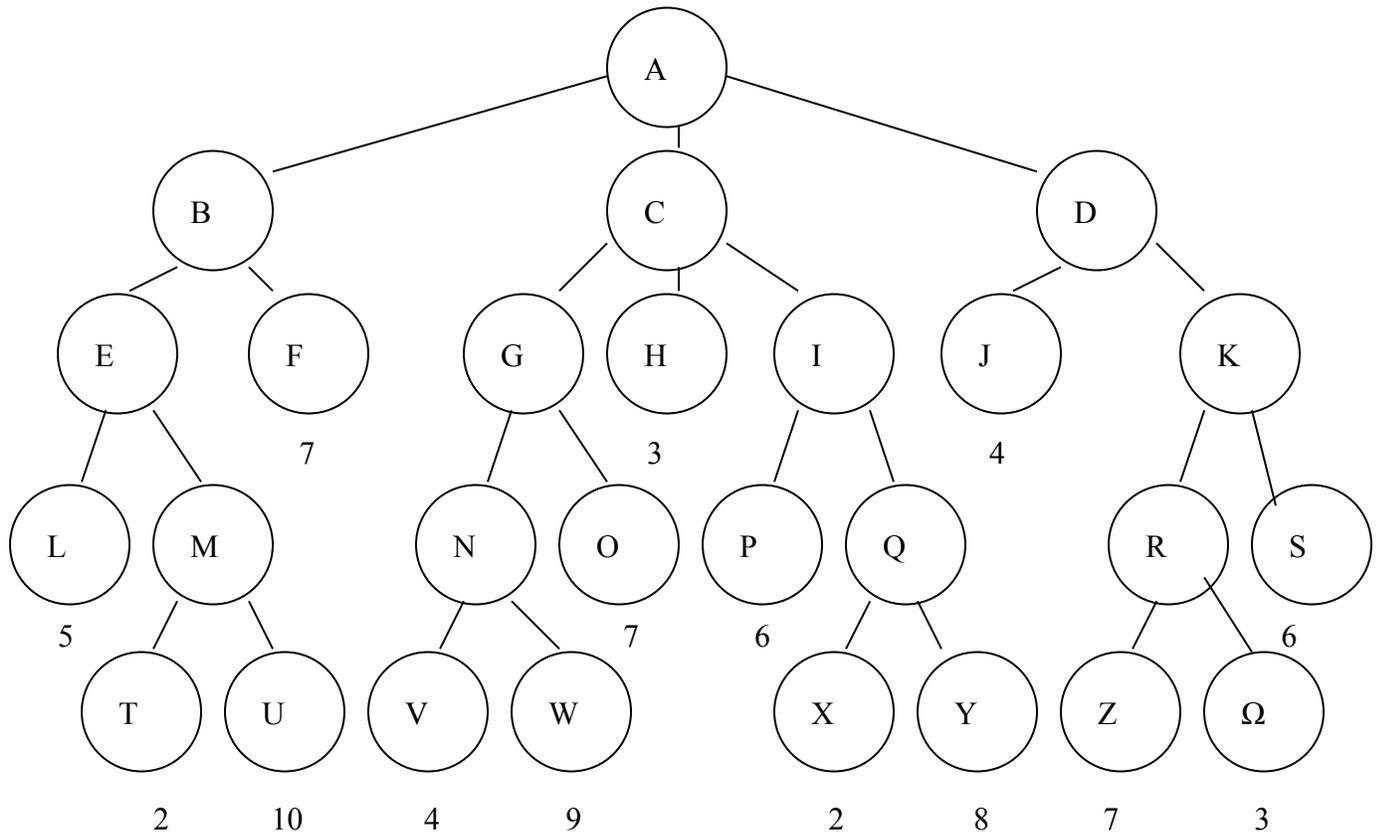
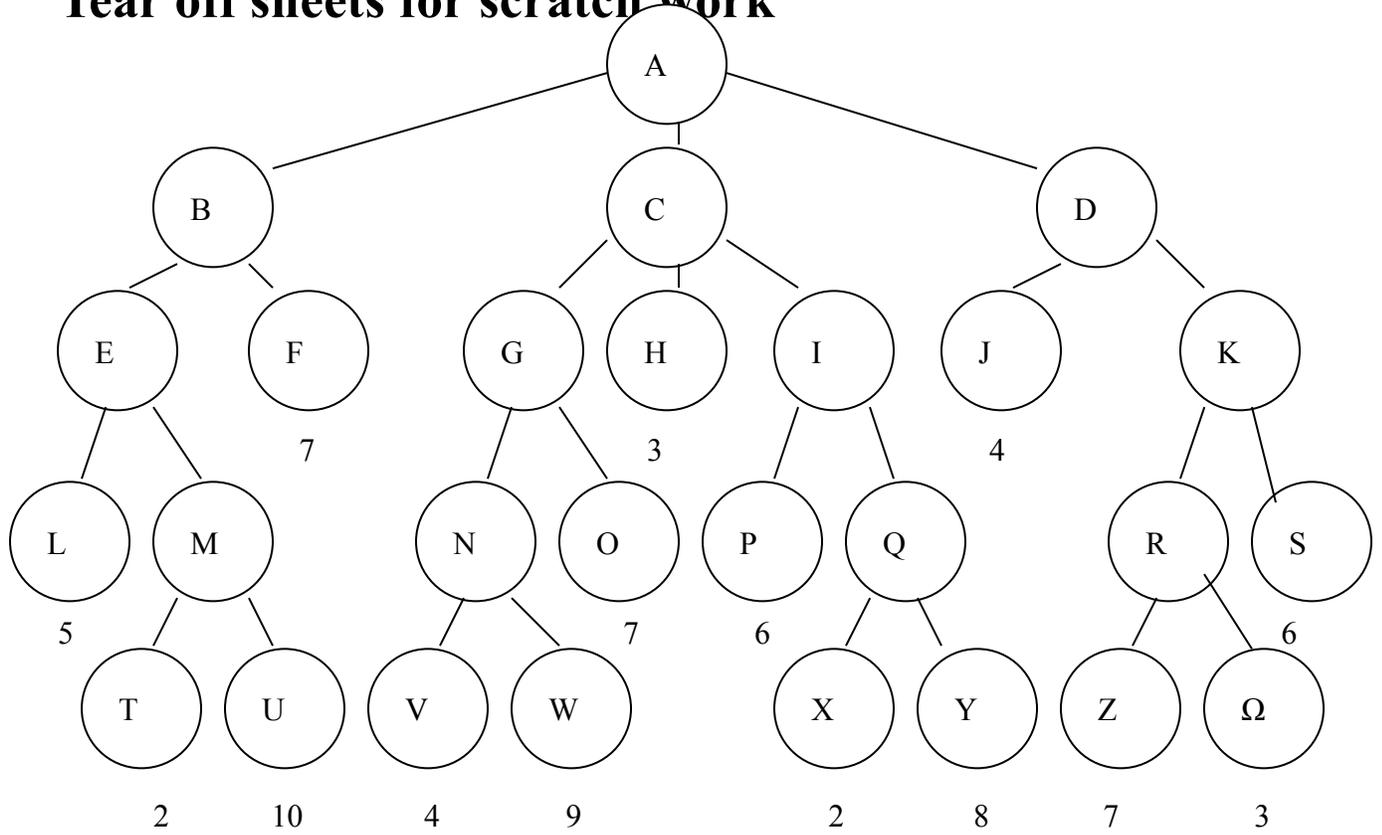
Show the the *full* search tree (up until you find a solution), starting with the **same pre-reduced domains**. You might want to work this out on a copy at the end of the quiz..

1	Mc
2	
3	
4	
5	
6	

Part D (10 points)

Obama and Biden hear that you've got a Nintendo Wii, and now both of them want to sit next to you. Keeping all the other constraints the same, describe what happens to your dinner party.

Tear off sheets for scratch work



Tear off sheet

- Palin wants to sit next to McCain
- Biden wants to sit next to Obama
- Neither McCain nor Palin will sit next to Obama or Biden
- Neither Obama nor Biden will sit next to McCain or Palin
- The moose is afraid to sit next to Palin
- No two people can sit in the same seat, and no one can sit in 2 seats.
- McCain insists on sitting in seat 1

Variables: You, Moose, McCain, Palin, Obama, Biden

Domains: Seats 1-6

Constraints: I-VII

You:	1	2	3	4	5	6
Moose:	1	2	3	4	5	6
McCain:	1	2	3	4	5	6
Palin:	1	2	3	4	5	6
Obama:	1	2	3	4	5	6
Biden:	1	2	3	4	5	6

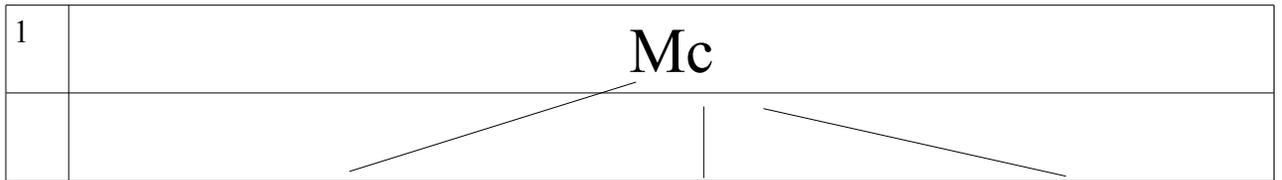
Variables: Seats 1-6

Domains: You, Moose, McCain, Palin, Obama, Biden

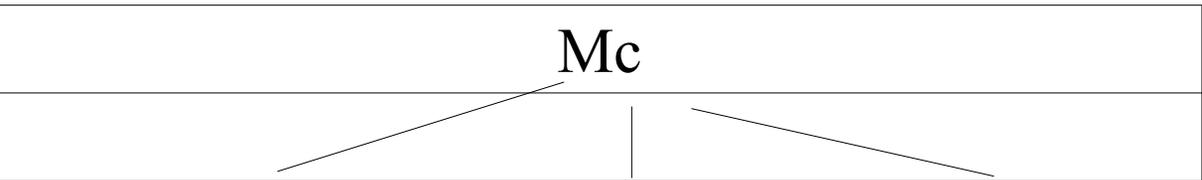
Constraints: I-VII

1:	You	Moose	McCain	Palin	Obama	Biden
2:	You	Moose	McCain	Palin	Obama	Biden
3:	You	Moose	McCain	Palin	Obama	Biden
4:	You	Moose	McCain	Palin	Obama	Biden
5:	You	Moose	McCain	Palin	Obama	Biden
6:	You	Moose	McCain	Palin	Obama	Biden

Tear off sheet

1	
2	<p>Y M P</p>
3	
4	
5	
6	

Tear off sheet

1	 <p>Mc</p>
2	 <p>Y M P</p>
3	
4	
5	
6	

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6.034 Artificial Intelligence
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