Name: _____________________________

1. [10 pts] Suppose a game player has constructed a game tree as given at right. In this tree, high numbers represent good boards for X, and it is currently X’s move. (As you can see, X has three possible moves from which to choose, labeled A, B, and C.)

   a. Fill in all empty circles with the values assigned them according to the minimax evaluation algorithm.
   
   b. Which move will X choose?

2. [10 pts] Consider the following context-free grammar.

   \[ S \rightarrow T + S | T \]
   \[ T \rightarrow F T | F \]
   \[ F \rightarrow x | y | (S) \]

   At right, draw a parse tree for the sentence \( x (x + y) \).

3. [10 pts] For each of the following, say whether the regular expression describes a language including the sentence. Your answer will be either “yes” or “no.”

   a. \( ab^* \) includes \( abab \)? ___
   
   b. \( (a | b)a \) includes \( aba \)? ___
   
   c. \( a (a | b)^* b \) includes \( abbbbaab \)? ___
   
   d. \( (a | b) (ba | ab)^* \) includes \( ababab \)? ___
   
   e. \( (a | b) (ba | ab)^* \) includes \( abababa \)? ___
Statistics

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#1. 6.19 / 10
#2. 7.14 / 10
#3. 8.38 / 10

+ 3-point bonus

1. a.  

![Tree Diagram]

b. $B$

2.  

![Decision Tree]

3. a. No, $ab^*$ does not include $abab$.
b. No, $(a|b)a$ does not include $aba$.
c. Yes, $a(a|b)^*b$ includes $abbaaab$.
d. No, $(a|b)(ba|ab)^*$ does not include $ababab$.
e. Yes, $(a|b)(ba|ab)^*$ includes $abababa$. 