# 2nd Midterm Exam

Tuesday November 18
75 minutes == 75 points
Open book and notes

1. *15 points*
   Show the backed-up values for all the nodes in the following game tree and show the branches that are pruned by alpha-beta. For each branch pruned, explain briefly why alpha-beta prunes it. Follow the convention used in the textbook to examine the branches in the tree from left to right.
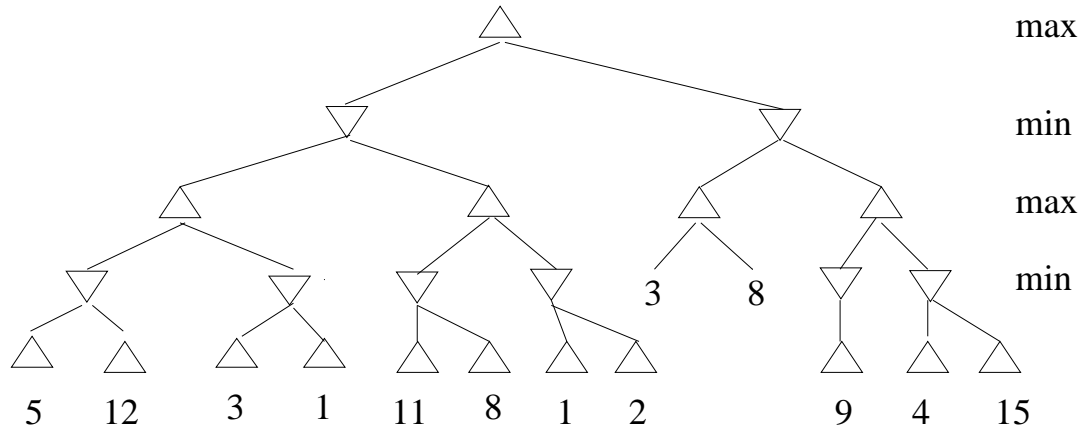
2. *10 points*

   1. What CSP algorithm would you use when given an incremental formulation of a CSP problem? justify briefly your choice.

   2. Why is a complete-state formulation a good choice for CSP when using local search? explain briefly.

3. *5 points*
   Show the results of applying the unification algorithm to the following expressions:

   1. UNIFY[p(x, f(u,x)), p(f(y,A), f(z,f(B,z)))]
   2. UNIFY [p(g(A), h(u,v)), p(g(w), h(w,B))]

4. *5 points*

   Convert to Conjunctive Normal Form the following expression:

   $\forall p[pet(p) \wedge \exists c[owner(c,p) \vee feeds(c,p)]] \Rightarrow happy(p)$

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5. *20 points*

   1. Write the following statements in predicate calculus, using the following predicates:

      Alone(x) : x is alone
      Friend(x,y) : x is a friend of y
      Grumpy(x) : x is grumpy
      Helpful(x,y) : x is helpful to y
      Sibling(x,y) : x is a sibling of y

      1. Anyone who has any sibling is not alone.
      2. If someone is grumpy, nobody is helpful to him.
      3. Friends are helpful.
      4. John has a sibling or a friend.

   2. Convert them to conjunctive normal form.

   3. Prove by resolution that "If John is grumpy, John is not alone."

6. *20 points*
   For each of the following sentences, decide if the logic sentence given is a correct translation of the English sentence or not. If not explain briefly why not and correct it. There can be more than one mistake in each expression.

   1. There is only one red mushroom.
      $\exists x\ mushroom(x) \wedge red(x) \wedge \neg\ [\exists y\ mushroom(y) \wedge red(y) \wedge x = y]$

   2. Any red mushroom costs less than any purple mushroom.
      $\forall x\ [mushroom(x) \wedge red(x)] \Rightarrow [\exists y\ mushroom(y) \wedge purple(y) \wedge cost(x) < cost(y)]$

   3. Some purple mushrooms are tastier than some red mushrooms.
      $\exists x \forall y\ [mushroom(x) \wedge purple(x) \wedge mushroom(y) \wedge red(y)] \Rightarrow tastier(x, y)$

   4. There is a mushroom that is tastier than any other mushroom.
      $\forall x \exists y\ [mushroom(x) \wedge mushroom(y)] \Rightarrow tastier(y, x)]$

   5. All mushrooms contain at least one vitamin.
      $\forall x\ [mushroom(x) \wedge \exists y\ vitamin(y)] \Rightarrow in(x, y)$

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Y‌OU REACHED THE END OF THE EXAM

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