CSci 4511
Midterm 2

Name: _____

Student ID: _____

Instructions: The time limit is 75 minutes. Please write your answers in the space below. If you need more space, write on the back of the paper. The exam is open book and notes. You may use electronic devices to ONLY look at either an e-book version or electronic notes. You may not use the internet, program/run code or any other outside resources. (If you are typing on your keyboard/input device for anything other than ctrl-F to find words in the e-book or notes, this is probably not acceptable.) For all questions you must **show work**.

Problem (1) [20 points] Make a payoff matrix for the game rock-paper-scissors. Then answer which sets of actions are pure Nash equilibrium? Which are pure Pareto optimal?

Problem (2) [10 points] Perform alpha-beta pruning on the tree shown below. Always search the branches from left to right. Show the alpha/beta values (best/worst values) along with what can be pruned after searching or pruning each diamond terminal state (i.e. you should have 2 partial trees and one full tree as your answer).

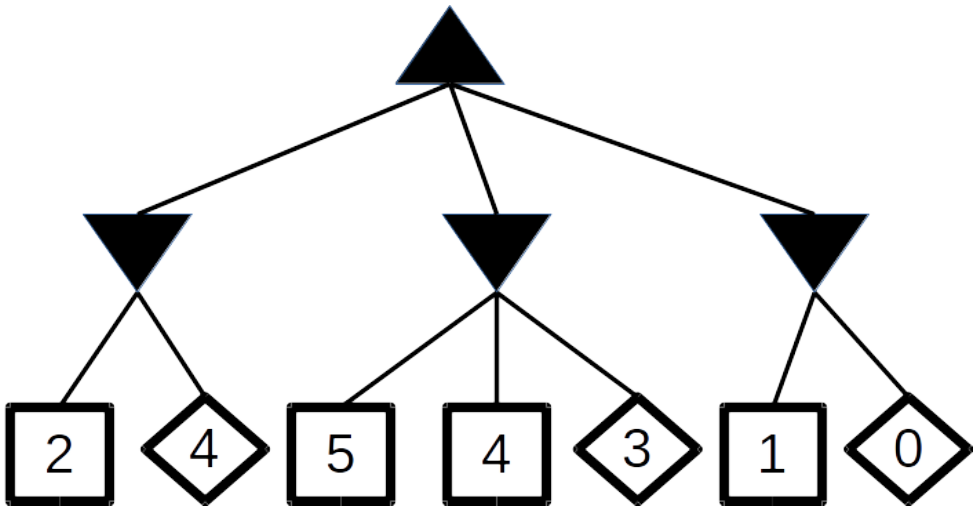

Figure 1: Tree to be pruned.

Problem (3) [20 points] You are going grocery shopping and have a $20 budget. You are trying to buy at least 1700 calories, 38g of protein and 120% iron. Assume the grocery store comes stocked with the items listed below (can buy multiple of each).

(1) Set this up as a constraint satisfaction problem. Then (2) describe whether you think using consistency constraints and inference or a more basic search is applicable to this problem.

- Potates. 110 calories, 3g protein and 6% iron for $1.
- Cereal (healthy-ish). 250 calories, 6g protein, 90% iron for $3
- Beef. 290 calories, 22g protein and 15% iron for $4

Problem (4) [20 points] Use resolution to answer the following questions. Assume the KB is:

$$(A \vee B \vee \neg C) \wedge (\neg B \vee \neg C \vee D) \wedge (\neg A \vee D) \wedge (B \vee C \vee \neg D) \wedge (A \vee \neg B \vee D)$$

(1) Does $KB \vDash (A \vee B)$?
(2) Does $KB \vDash (\neg C \wedge B)$?

Problem (5) [30 points] Answer and justify the following questions:

- Can you potentially prune more or less of the overall percent of leaf/terminal nodes if your tree has a larger branching factor?
- Suppose you are making a propositional knowledge base (KB) that you will query often. You use resolution to ask if $KB \vDash \alpha$ for some sentence α. If it is entailed you add α to your KB. If it is not entailed, you add $\neg\alpha$ to your KB. You add these sentences to your KB to speed up future computations. Is this approach a good idea? Why or why not?