Fall 2005 Exam 2 Periods

(20) Conversion to Clause Form

I. Transform the wff A below into CNF (clause form) matrix form. For each of the 10 “official steps” required give a brief description of the step and perform the step or write N/A {not applicable} on the space provided. Failure to follow this format will result in no credit. In wff A the set \{w,x,y,t\} are variables, the set \{P,Q,R,A,B\} are functions and there are no constants.

\[ \{\text{wff } A\} : (\forall x)(P(x) \rightarrow (A(x) \land B(x)) \lor \neg C(x, w)) \lor (\forall y)(\exists u) [Q(y, t) \lor ((\forall x) R(x) \rightarrow \neg B(y))] \]

(2) Step 0:

(2) Step 1:

(2) Step 2:

(1) Step 3:

(2) Step 4:

(1) Step 5:

(4) Step 6:
I. Conversion to Clause Form (continued)

(1) Step 7: ____________________________

(1) Step 8: ____________________________

(2) Step 9: ____________________________

(2) Step 10: ____________________________
II. Resolution Refutation

The members of the Elm St. Bridge Club are Joe, Sally, Bill, and Ellen. Joe is married to Sally. Bill is Ellen’s brother. The spouse of every married person in the club is also in the club. The last meeting of the club was at Joe’s house. PROVE THAT (1) the last meeting of the club was at Sally’s house & (2) Ellen is not married.

Solve by drawing a Refutation Graph resulting from your choice of strategy. (Make sure you mark clearly the required substitutions).

[Required: Please note the assigned point values. Each part MUST be answered with something. If left blank, then no credit will be assigned]

(5) a. Represent the axioms/goal in the Predicate Calculus.
(2) b. Represent any commonsense knowledge needed to solve the problem using Predicate Calculus,
(5) c. Convert your axioms, goal and commonsense knowledge (if any) to clause form,
(10) d. Draw your Refutation Graph, show substitutions are consistent.
(3) e. Describe how your graph meets the strategy. What other strategy could you have used and why?

(5) Answers Part a:

(2) Answers Part b:

(5) Answers Part c:
II. Resolution Refutation (continued)

(10) Refutation Graph Part d:

(3) Answer Part e: My strategy is ____________________________
(30)

III. Heuristic Search

The following figure shows a search tree with the state indicated by the tuple inside parentheses. A letter indicates the state name and the integer indicates the estimated cost for finding a solution from that state (a cost of 0 indicates a goal state). Using the Graph-Search algorithm discussed in class, give the algorithm steps using (1) breadth-first search. How many nodes did breadth-first expand? Repeat using (2) depth-first search. How many nodes did depth-first expand? Repeat using (3) heuristic search (you MUST specify a rule to break ties). How many nodes did heuristic search expand? Repeat using (4) A* search. How many nodes did A* expand? You must clearly justify your answer(s). "Feelings" or "intuition" are not good/sound reasons. NO JUSTIFICATION <= NO CREDIT. You must give me the details of each step of the algorithm in order to receive any credit for each case. Can any of these algorithms ever find N as a solution? Explain

Breadth First:
III. Heuristic Search. (continued)

DEPTH-FIRST:

HEURISTIC-SEARCH:

A* SEARCH:
IV. Computation Deduction.

We wish to find the last coach in a short list of UF coaches. Using **Resolution Refutation** deduce the following computation to obtain a value for the goal (3 pts) by performing a consistent Refutation Trace (17 pts) for the goal and **prove (or provide a good argument)** its consistency (5 pts.) Make sure your resolution refutation trace is clearly marked and it follows a complete strategy.

Facts:

\[ F_1: \text{last(cons(U,nil),U)}. \]

Rules:

\[ R_1: \text{last}(X,Y) \rightarrow \text{last(cons(W,X),Y)} \]

Goal: \( \exists z \) last(cons(steve, cons(ron, cons(urban,nil))), z)

(Note: If you prefer, you may use the notation last( (steve ron urban), z).)

Required: Give the resolution trace (17 pts), show the substitutions are consistent (5 pts), and obtain the value of the goal (3 pts).
Fall 2006 was a Two-Period Exam
(20) Conversion to Clause Form
I. Transform the wff $A$ below into CNF (clause form) matrix form. For each of the 10 “official steps” required give a brief description of the step and perform the step or write N/A{not applicable} on the space provided. Failure to follow this format will result in no credit. In wff $A$ the set $\{w,x,y\}$ are variables, the set $\{E\}$ are functions and there are no constants.

$$\{\text{wff } A\} : (\forall x)\{\ \sim E(x,v) \rightarrow [ (\exists y) (\exists w) (E(y,w) \land (\forall x) \{E(x,w) \rightarrow E(y,x)\})]\}$$

(2) Step 0: 

(2) Step 1: 

(2) Step 2: 

(1) Step 3: 

(2) Step 4: 

(1) Step 5: 

(4) Step 6: 

I. Conversion to Clause Form (continued)

(1) Step 7: ____________________________________________________________

(1) Step 8: ____________________________________________________________

(2) Step 9: ____________________________________________________________

(2) Step 10: ____________________________________________________________
II. Resolution Refutation

THE CUSTOM OFFICIALS SEARCHED EVERYONE WHO ENTERED THIS COUNTRY WHO WAS NOT A VIP. SOME OF THE DRUG PUSHERS ENTERED THIS COUNTRY AND THEY WERE ONLY SEARCHED BY DRUG PUSHERS. NO DRUG PUSHER WAS A VIP. PROVE THAT SOME OF THE CUSTOM OFFICIALS WERE DRUG PUSHERS.

Solve by drawing a Refutation Graph resulting from your choice of strategy. (Make sure you mark clearly the required substitutions).

[Required: Please note the assigned point values. Each part MUST be answered with something. If left blank, then no credit will be assigned]

(5) a. Represent the axioms/goal in the Predicate Calculus. Let E(x) mean “x entered this country,” V(x) mean “x was a VIP,” S(x,y) mean “y searched x,” C(x) mean “x was a custom official” and P(x) mean “x was a drug pusher.”

(2) b. Represent any commonsense knowledge needed to solve the problem using Predicate Calculus.

(5) c. Convert your axioms, goal and commonsense knowledge (if any) to clause form.

(10) d. Draw your Refutation Graph, show substitutions are consistent.

(3) e. Describe how your graph meets the strategy. What other strategy could you have used and why?

(5) Answers Part a:

(2) Answers Part b:

(5) Answers Part c:
II. Resolution Refutation (continued)

(10) Refutation Graph Part d:

(3) Answer Part e: My strategy is ________________________
III. Heuristic Search

A map is to be colored with a set of n distinct colors, such that no two adjacent countries have the same color. If you can use colors {yellow, red, white and green} what is a legal coloring for the following map? Colorings are represented as lists of pairs:

( (country color) (country color)...)

a. Suppose Sol_1 represents the use of the A* algorithm with heuristic function h_1(n)=number of uncolored countries.
b. Suppose Sol_2 represents the use of the A* algorithm with heuristic function h_2(n)=Of two states with the same number of uncolored countries, the one with more options open is better. The number of options of a partial coloring might be measured by finding the uncolored country with the fewest possible colors, and returning the number of possible colors for that country.
c. Give the A* results for Sol_1 and for Sol_2 if the countries are always picked in {H C P K B M} order and the colors are picked in {Y R W G} order. How much better is Sol_2 over Sol_1?
III. Heuristic Search (continued)

Suppose Sol2 represents the use of the A* algorithm with heuristic function $h_2(n)=\text{Of two states with the same number of uncolored countries, the one with more options open is better. The number of options of a partial coloring might be measured by finding the uncolored country with the fewest possible colors, and returning the number of possible colors for that country}.
Fall 2006

(25)

IV. Computation Deduction.

We wish to make a set of UF basketball centers from a list of tall players. Using Resolution Refutation deduce the following computation to obtain a value for the goal (2 pts) by performing a consistent Refutation Trace (19 pts) for the goal and prove (or provide a good argument for) its consistency (4 pts.) Make sure your resolution refutation trace is clearly marked and it follows a complete strategy. Assume that the evaluation of member is built-in, e.g., member(a,(a b)) returns true, and member (c,(a b)) returns nil.

Facts:

\[ F_1: \text{makeset}(\text{nil},\text{nil}). \]

Rules:

\[ R_1: [ \text{member}(X_1,Y_1) \land \text{makeset}(Y_1,Z_1) ] \rightarrow \text{makeset}(X_1,Y_1,Z_1). \]

\[ R_2: [ \neg \text{member}(X_2,Y_2) \land \text{makeset}(Y_2,Z_2) ] \rightarrow \text{makeset}(X_2,Y_2,\text{cons}(X_2,Z_2)). \]

Goal: \((\exists z)(\text{makeset}(\text{cons}(AL, \text{cons}(JOAKIM, \text{cons}(AL,\text{nil}))), z))\)

{ Note: If you prefer, you may use the notation makeset( (AL JOAKIM AL), z) }

Required: Give the entire resolution trace (18 pts) using a complete strategy (tell me what strategy (1)), show the substitutions are consistent (4pts), and obtain the value of the goal (2 pts).
IV. Computation Deduction. (continued)
Fall 2007

(20) Conversion to Clause Form

I. Transform the wff \( A \) below into clause form. For each of the 10 “official steps” {the order is important!} required give a brief description of the step and perform the step or write N/A {not applicable} on the space provided. Failure to follow this format will result in no credit. In \( wff \ A \) the set \( \{v, x, y, z\} \) are variables, the set \( \{P, Q, R\} \) are functions and there are no constants.

\[
\{wff \ A\} : (\forall x)(P(x) \rightarrow (\forall y)(\neg Q(x, y) \rightarrow P(v)) \land \forall y \exists z (R(x, y) \rightarrow P(x)))
\]

(2) Step 0: ________________________________

(2) Step 1: ________________________________

(2) Step 2: ________________________________

(1) Step 3: ________________________________

(2) Step 4: ________________________________

(1) Step 5: ________________________________

(4) Step 6: ________________________________
I. Conversion to Clause Form (continued)

(1) Step 7: 

(1) Step 8: 

(2) Step 9: 

(2) Step 10: 
II. Resolution Refutation

The mathematical definition of the factorial function is: (i) Fact(0)=1,  (ii) Fact(k)=k*Fact(k-1)

Some suitable axioms for factorial are: 

(i) Fact(0)=1

(ii) [k-1=\textcolor{red}{j} \land \textcolor{red}{Fact(j)}=\textcolor{red}{m} \land \textcolor{red}{k}\cdot\textcolor{red}{m}=\textcolor{red}{n}] \rightarrow [\textcolor{red}{Fact(k)}=\textcolor{red}{n}]

(iii) (\forall x)(\forall y)[x=y] \text{ with side effect } \{\text{eval}(x)/y\}

Using the axioms find the value of 2! by using Resolution Refutation and answer extraction. Solve by drawing a Refutation Graph resulting from your choice of strategy. (Make sure you indicate clearly the required substitutions). Note: the function x=y evaluates the left argument and unifies it (equates it) with the right argument, e.g., 4-2=q evaluates 4-2 to 2 and sets q=2 (i.e., it stores the substitution \{4-2/x, eval(4-2)/y, q/y, 2/q\} in the system.)

[Required: Please note the assigned point values. Each subpart MUST be answered with something. If left blank, then zero credit]

(4) a. Represent the axioms/goal in clause form.
(2) b. Is any commonsense knowledge needed to solve the problem using Predicate Calculus? Explain.
(14) c. Give the Resolvents with the required substitutions.
(5) d. Draw your Refutation Graph.
(3) e. Prove formally that your substitutions are consistent.
(2) f. Describe how your graph meets the strategy. What other strategy could you have used and why?

(4) Answers Part a:

(2) Answer Part b:

(14) Answers (Resolvents & required substitutions) Part c:
II. Resolution Refutation (continued)

(5) Refutation Graph Part d:

(3) Consistency Check Part e:

(2) Answer Part f: My strategy is

What other strategy could you have used and why? Explain:
III. Adversarial Search

Consider the following game tree in which the static scores (in parentheses at the tip nodes) are all from the first player’s point of view.

(a) Assuming that the first player is the maximizing player, what move should the first player choose?

(b) Assuming that the first player is the minimizing player, what move should the first player choose?

(c) What nodes would not need to be examined in part (a) using the alpha-beta algorithm—assuming that the nodes are examined in left-to-right order?

(d) What nodes would not need to be examined in part (b) using the alpha-beta algorithm—assuming that the nodes are examined in left-to-right order?

(e) Is the first player’s move in parts (a) and (c) or in parts (b) and (d) different? Explain.
III. Adversarial Search. (continued)

(5) Part (d):

(5) Part (e):
Fall 2007
(25)

IV. Computation Deduction.

The following facts and rules accomplish the evaluation of the inner product of two vectors. Note that \{A,As,B,Bs,N,Z\} are variables

Fact:

\begin{align*}
F_1 &: \text{inner}(\text{nil},\text{nil},0).
F_2 &: \text{is}(X,Y) \text{ with side effect } \{\text{eval}(X)/Y\}.
\end{align*}

Rule:

\begin{align*}
R_1 &: [\text{inner}(\text{As},\text{Bs},N) \land \text{is}(N+A*B,N)] \rightarrow \text{inner}(\text{cons}(A,\text{As}),\text{cons}(B,\text{Bs}),N).
\end{align*}

Goal: \((\exists Z)(\text{inner}(\text{cons}(1, \text{cons}(2,\text{nil})), \text{cons}(3, \text{cons}(4,\text{nil})), Z))\)

\{ Note: If you prefer, you may use the notation inner((1 2), (3 4), Z) \}

Required: Tell me what your strategy is (1 pt). Give the clause form (4 pts) of the axiom set & the negation of the goal. Give me the Resolution resolvents (15 pts) using a complete strategy. Prove the substitutions are consistent (4 pts). Obtain the value of the goal (1 pt). Note: the function \text{is}(X,Y) evaluates the left argument and unifies it (equates it) with the right argument, e.g., \text{is}(4+2,Q) evaluates 4+2 to 6 and sets Q=6 (i.e., it stores the substitution \{4+2/X, eval(4+2)/Y, Q/Y, 6/Q\} or \{6/Q\} in the system.)

(1) Tell me your strategy

(4) Give me your axioms & negation of the goal in clause form

(15) Give me the resolution resolvents
IV. Computation Deduction, (continued)

(4) Prove the substitutions are consistent.

(1) Give me the solved goal, i.e., the answer:
Fall 2008

(20) Conversion to Clause Form

1. Transform the wff $A$ below into clause form. For each of the 10 “official steps” *(the order is important!)* required give a brief description of the step and perform the step or write N/A {not applicable} on the space provided. Failure to follow this format will result in no credit. In $A$ the set \{w, x, y, z\} are variables, the set {Animal, Loves} are functions and there are no constants.

$$\{wff \ A\} : (\forall x)(\exists w)((\forall y)\{Animal(y) \rightarrow Loves(x,y)\} \rightarrow ((\forall z)(\exists y)Loves(y,x)))$$

(2) Step 0: ____________________________

(2) Step 1: ____________________________

(2) Step 2: ____________________________

(1) Step 3: ____________________________

(2) Step 4: ____________________________

(1) Step 5: ____________________________

(4) Step 6: ____________________________

I. Conversion to Clause Form (continued)
(1) Step 7: 

(1) Step 8: 

(2) Step 9: 

(2) Step 10: 
II. Resolution Refutation (30)

The law says that it is a crime for an American to sell weapons to hostile nations. The country Nono, an enemy of America, has some missiles, and all of its missiles were sold to it by Colonel West, who is an American. Is Colonel West a criminal?

Prove that West is a criminal by using Resolution Refutation. Draw a Refutation Graph resulting from your choice of strategy. (Indicate clearly the required substitutions).

[Required: Please note the assigned point values. Each subpart MUST be answered with something. If left blank, then zero credit]

5. a. Represent the axioms/goal in the Predicate Calculus. (If you cannot do this, I will give it to you for the 5 points)

4. b. Represent the axioms/goal in clause form.

2. c. Is any commonsense knowledge needed to solve the problem? Explain. (If you can’t do it, I will give it to you for 2 pts)

10. d. Give the Resolvents with the required substitutions.

2. e. Draw your Refutation Graph.

2. f. Prove formally that your substitutions are consistent.

2. g. Describe how your graph meets the strategy. What other strategy could you have used and why?

5. Answers Part a:

4. Answer(s) Part b:

2. Answer(s) Part c:

10. Answers (Resolvents & required substitutions) Part d:
II. Resolution Refutation (continued)

(5) Refutation Graph Part d:

(2) Consistency Check Part e:

(2) Answer Part f: My strategy is: ________________________________
What other strategy could you have used and why? Explain:
III. Adversarial Search

Consider the following game tree in which the static scores (in parentheses at the tip nodes) are all from the first player’s point of view.

(5) a. Assuming that the first player is the maximizing player, what move should the first player choose?

(5) b. Assuming that the first player is the minimizing player, what move should the first player choose?

(5) c. What nodes would not need to be examined in part (a) using the alpha-beta algorithm—assuming that the nodes are examined in left-to-right order?

(5) d. What nodes would not need to be examined in part (b) using the alpha-beta algorithm—assuming that the nodes are examined in left-to-right order?

(5) e. Is the first player’s move in parts (a) and (c) or in parts (b) and (d) different? Explain.

(A)

(B) (C) (D)

(E 3) (F 12) (G 8) (H 2) (I 4) (J 6) (K 14) (L 5) (M 2)

(5) Part (a):

(5) Part (b):

(5) Part (c):
III. Adversarial Search. (continued)

(5) Part (d):

(5) Part (e):
IV. Computation Deduction.

In EEL-5840 Exam 1 we have a TAIL RECURSIVE LISP function COUNT-TOP-ATOMS (CTA for short) to count the number of top level atoms in a given list expression. Here are fact(s) and rule(s) to define the equivalent predicate IS_CTA(LIS,N). IS_CTA(LIS,N) is true when N equals the count of the number of top level atoms in LIS.

\[ F_1: IS\_CTA(NIL, 0). \]
\[ R_1:[\text{ATOM}(U) \land IS\_CTA(T,N) \land IS(N+1,ANS)] \rightarrow IS\_CTA(CONS(U,T),ANS) \]
\[ R_2:[\text{LISTP}(U) \land IS\_CTA(T,ANS)] \rightarrow IS\_CTA(CONS(U,T),ANS) \]

Evaluate \((\exists Z)\text{IS\_CTA(CONS(CONS(A,NIL),CONS(B,CONS(CONS(C,NIL),NIL)))),Z})\) using computation deduction.

{ Note: If you prefer, you may use the notation \text{IS\_CTA}(((A) B (C)),Z), and \text{ATOM} and \text{LISTP} are the built-in LISP functions we already know}

Required: Tell me what your strategy is (1 pt). Give the clause form (4 pts) of the axiom set & the negation of the goal. Give me the Resolution resolvents (16 pts) using a complete strategy. Prove the substitutions are consistent (3 pts). Obtain the value of the goal (1 pt). Note: the function IS(X,Y) evaluates the left argument and unifies it (equates it) with the right argument, e.g., IS(4+2,Q) evaluates 4+2 to 6 and sets Q=6 (i.e., it stores the substitution \{4+2/X, eval(4+2)/Y, Q/Y, 6/Q\} or \{6/Q\} in the system.)

(1) Tell me your strategy___________________________

(4) Give me your axioms & negation of the goal in clause form

(16) Give me the resolution resolvents
IV. Computation Deduction, (continued)

(3) Prove the substitutions are consistent.

(1) Give me the solved goal, i.e., the answer:
Fall 2009 Exam: Two Periods

(20) **Conversion to Clause Form**

I. Transform the wff $A$ below into **clause form**. For each of the 10 “**official steps**” **(the order is important!)** required give a brief description of the step and perform the step or write N/A {not applicable} on the space provided. Failure to follow this format will result in **no credit**. In $wff A$ the set \{w, x, y, z\} are variables, the set \{R,S\} are functions and there are no constants.

\[
\{wff A\} : (\forall x)(R(x,y) \rightarrow \exists z(\neg \forall y[S(x,y) \rightarrow R(x,w)] \land \forall y[S(x,y) \rightarrow R(x,y)])
\]

(2) Step 0: ____________________________________________________________

(2) Step 1: ____________________________________________________________

(2) Step 2: ____________________________________________________________

(1) Step 3: ____________________________________________________________

(2) Step 4: ____________________________________________________________

(1) Step 5: ____________________________________________________________

(4) Step 6: ____________________________________________________________
I. Conversion to Clause Form (continued)

(1) Step 7: ________________________________

(1) Step 8: ________________________________

(2) Step 9: ________________________________

(2) Step 10: ________________________________
II. Resolution Refutation (30)

The members of the EEL-5840 Gator club are Joe, Sally, Bill, and Ellen. Joe is married to Sally. Bill is Ellen’s brother. The spouse of every married person in the club is also in the club. The last meeting of the club was at Joe’s house. Was the last meeting of the club at Sally’s house? Is Ellen not married?

Prove the two goals by using Resolution Refutation. Draw a Refutation Graph resulting from your choice of strategy. (Indicate clearly the required substitutions).

[Required: Please note the assigned point values. Each subpart MUST be answered with something. If left blank, then zero credit]

(5) a. Represent the axioms/goal in the Predicate Calculus. (If you cannot do this, I will give it to you for the 5 points)

(4) b. Represent the axioms/goal in clause form.

(2) c. Is any commonsense knowledge needed to solve the problem? Explain. (If you can’t do it, I will give it to you for 2 pts)

(10) d. Give the Resolvents with the required substitutions.

(5) e. Draw your Refutation Graph.

(2) f. Prove formally that your substitutions are consistent.

(2) g. Describe how your graph meets the strategy. What other strategy could you have used and why?

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<th>Answers Part a:</th>
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<td>Answer(s) Part b:</td>
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<td>Answer(s) Part c:</td>
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<td>(10)</td>
<td>Answers (Resolvents &amp; required substitutions) Part d:</td>
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</table>
II. Resolution Refutation (continued)

(5) Refutation Graph Part d:

(2) Consistency Check Part e:

(2) Answer Part f: My strategy is: ____________________________________________
What other strategy could you have used and why? Explain:
(25)

III. Heuristic Search

The Four-Queens problem requires one to place four queens on a 4 x 4 checkerboard so no two can attack each other. A suitable Heuristic is \( h(n) = \text{length of the longest empty diagonal available to the queen in the rows where there are no queens} \) (e.g., for a queen in row 1 \( h(n) \leq 3 \), for a queen in row 2 \( h(n) \leq 2 \), for a queen in row 3 \( h(n) \leq 1 \) and for a queen in row 4 \( h(n)=0 \)). Find the solution and give the algorithm steps using (1) A* search and (2) Heuristic search. In particular, how many nodes did A* and Heuristic search expand? Which algorithm performs the best? You must clearly justify your answer(s). "Feelings" or "intuition" are not good/sound reasons. NO JUSTIFICATION \(\implies\) NO CREDIT. You must give me the details of each step of the algorithm in order to receive any credit for each case. Can any of these algorithms ever multiple solutions? Explain. Assume when sorting that the stable sort routine places the nodes with the newest \( f \) values in the list ahead of others with same \( f \) value previously on the list (LIFO). \( \Gamma \) expands only legal nodes (\( \Gamma \) does not expand nodes which are under attack).

### SOLUTION 1

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### SOLUTION 2

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A* Search:

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Heuristic Search:
III. Heuristic Search (continued)

Which algorithm performs the best?

Can any of these algorithms ever multiple solutions?
IV. Computation Deduction.

The following facts and rules establish that an English Noun Phrase (NP) is defined as a determiner, followed by an adjective, followed by a noun or a determiner followed by a noun. Set \{a,b,c,d\} are variables, set \{THE,GATORS,UNDEFEATED\} are constants, and set \{NP,DET,N,ADJ\} are functions/predicates.

\[
F_1: \text{DET}(\text{CONS}(\text{THE},a),a).
F_2: \text{ADJ}(\text{CONS}(\text{UNDEFEATED},a),a).
F_3: \text{N}(\text{CONS}(\text{GATORS},a),a).
R_1: [\text{DET}(a,b) \land \text{N}(b,c)] \rightarrow \text{NP}(a,c)
R_2: [\text{DET}(a,b) \land \text{ADJ}(b,c) \land \text{N}(c,d)] \rightarrow \text{NP}(a,d)
\]

Evaluate the goal: \text{NP}(\text{CONS}(\text{THE},\text{CONS}(\text{UNDEFEATED},\text{CONS}(\text{GATORS},\text{NIL}))),\text{NIL}) using computation deduction.

(Note: If you prefer, you may use the notation \text{NP}((\text{THE UNDEFEATED GATORS}),\text{NIL}) \}

Required: Tell me what your strategy is (1 pt). Give the clause form (3 pts) of the axiom set & the negation of the goal. Give me the Resolution resolvents (16 pts) using a complete strategy if you use Top-Down/Left-Right as a selection strategy. Prove the substitutions are consistent (4 pts). Obtain the value of the goal (1 pt).

(1) Tell me your strategy __________________________

(3) Give me your axioms & negation of the goal (the set \Gamma) in clause form

(16) Give me the Resolution Resolvents (there are a minimum six of them).
IV. Computation Deduction. (continued)

(4) Prove the substitutions are consistent.

(1) Give me the solved goal, i.e., the answer: