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CSC-366

Crypto: Heuristic Problem Solver Task 3

% H1
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situation1 :-
        problem(Numbers,Goal),
        Goal=goal(0),
        Numbers=numbers(N1,N2,N3,N4,N5),
        member(0,[N1,N2,N3,N4,N5]).
action1 :-
        problem(Numbers,_),
          Numbers=numbers(N1,N2,N3,N4,N5),
          assert(solution(ex(N1,*,ex(N2,*,ex(N3,*,ex(N4,*,N5)))))).

?- solve(numbers(5,4,0,8,9),goal(0)).
Numbers = {5, 4, 0, 8, 9} Goal = 0
considering rule 1 ...
application of rule 1 produces ( 5 * ( 4 * ( 0 * ( 8 * 9 ) ) ) )
true .

?- solve(numbers(0,5,3,5,8),goal(0)).
Numbers = {0, 5, 3, 5, 8} Goal = 0
considering rule 1 ...
application of rule 1 produces ( 0 * ( 5 * ( 3 * ( 5 * 8 ) ) ) )
true .

?- solve(numbers(7,6,7,1,0),goal(0)).
Numbers = {7, 6, 7, 1, 0} Goal = 0
considering rule 1 ...
application of rule 1 produces ( 7 * ( 6 * ( 7 * ( 1 * 0 ) ) ) )
true .
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% H2
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situation2 :-
        problem(numbers(N1,N2,N3,N4,N5),goal(G)),
        member(G,[N1,N2,N3,N4,N5]),
        member(0,[N1,N2,N3,N4,N5]),
        not(G=0).
action2 :-
        problem(_,goal(G)),
          other_numbers(special(G),others(A,B,C,D)),
          assert(solution(ex(G,+,ex(A,*,ex(B,*,ex(C,*,D)))))).

?- solve(numbers(7,0,9,2,6),goal(9)).
Numbers = {7, 0, 9, 2, 6} Goal = 9
considering rule 2 ...
application of rule 2 produces ( 9 + ( 7 * ( 0 * ( 2 * 6 ) ) ) )
true .

?- solve(numbers(5,4,3,1,0),goal(4)).
Numbers = {5, 4, 3, 1, 0} Goal = 4
considering rule 2 ...
application of rule 2 produces ( 4 + ( 5 * ( 3 * ( 1 * 0 ) ) ) )
true .

?- solve(numbers(0,2,3,5,3),goal(3)).
Numbers = {0, 2, 3, 5, 3} Goal = 3
considering rule 2 ...
application of rule 2 produces ( 3 + ( 0 * ( 2 * ( 5 * 3 ) ) ) )
true .

% H3
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situation3 :-
        problem(_,goal(0)),
        doubleton.
action3 :-
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        doubleton(doubleton(A,B),rest(C,D,E)),
        assert(solution(ex(ex(A,-,B),*,ex(C,*,ex(D,*,E))))).

?- solve(numbers(4,5,6,4,9),goal(0)).
Numbers = {4, 5, 6, 4, 9} Goal = 0
considering rule 3 ...
application of rule 3 produces ( ( 4 - 4 ) * ( 5 * ( 6 * 9 ) ) )
true .

?- solve(numbers(5,0,6,0,7),goal(0)).
Numbers = {5, 0, 6, 0, 7} Goal = 0
considering rule 3 ...
application of rule 3 produces ( ( 0 - 0 ) * ( 5 * ( 6 * 7 ) ) )
true .

?- solve(numbers(1,0,1,2,3),goal(0)).
Numbers = {1, 0, 1, 2, 3} Goal = 0
considering rule 3 ...
application of rule 3 produces ( ( 1 - 1 ) * ( 0 * ( 2 * 3 ) ) )
true .

% H4
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situation4 :-
          problem(_,goal(1)),
        doubleton(doubleton(A,B),rest(C,D,E)),
          remove(0, [C,D,E], Others),
          nth0(0,Others,F),
          nth0(1,Others,G),
          defTemp(A,B,0,F,G).

action4 :-
          temp(A,B,C,D,E),
          assert(solution(ex(ex(A,/,B),*,ex(C,*,ex(D,*,E))))).

?- solve(numbers(5,4,0,5,3),goal(1)).
Numbers = {5, 4, 0, 5, 3} Goal = 1
considering rule 4 ...
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application of rule 4 produces ( ( 5 / 5 ) * ( 0 * ( 4 * 3 ) ) )
true .

?- solve(numbers(0,3,2,7,7),goal(1)).
Numbers = {0, 3, 2, 7, 7} Goal = 1
considering rule 4 ...
application of rule 4 produces ( ( 7 / 7 ) * ( 0 * ( 3 * 2 ) ) )
true .

?- solve(numbers(5,6,8,0,8),goal(1)).
Numbers = {5, 6, 8, 0, 8} Goal = 1
considering rule 4 ...
application of rule 4 produces ( ( 8 / 8 ) * ( 0 * ( 5 * 6 ) ) )
true .
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% H5

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situation5 :-
        problem(_,goal(G)),
        doubleton(doubleton(A,B),rest(C,D,E)),
        remove(G,[C,D,E],Others),
        nth0(0,Others,F),
        nth0(1,Others,H),
        defTemp(A,B,G,F,H).

action5 :-
        temp(A,B,C,D,E),
        assert(solution(ex(C,+,ex(ex(A,-,B),*,ex(D,*,E))))).

?- solve(numbers(2,3,3,6,7),goal(6)).
Numbers = {2, 3, 3, 6, 7} Goal = 6
considering rule 5 ...
application of rule 5 produces ( 6 + ( ( 3 - 3 ) * ( 2 * 7 ) ) )
true .

?- solve(numbers(2,3,1,8,8),goal(1)).
Numbers = {2, 3, 1, 8, 8} Goal = 1
considering rule 5 ...
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application of rule 5 produces ( 1 + ( ( 8 - 8 ) * ( 2 * 3 ) ) )
true .

?- solve(numbers(5,6,4,4,2),goal(2)).
Numbers = {5, 6, 4, 4, 2} Goal = 2
considering rule 5 ...
application of rule 5 produces ( 2 + ( ( 4 - 4 ) * ( 5 * 6 ) ) )
true .
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% H6

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situation6 :-
        problem(numbers(A,B,C,D,E),goal(G)),
        same([A,B,C,D,E,G]),
        defTemp(A,B,G,D,E).

action6 :-
        temp(A,B,C,D,E),
        assert(solution(ex(A,+,ex(ex(B,-,C),+,ex(D,-,E))))).

?- solve(numbers(1,1,1,1,1),goal(1)).
Numbers = {1, 1, 1, 1, 1} Goal = 1
considering rule 6 ...
application of rule 6 produces ( 1 + ( ( 1 - 1 ) + ( 1 - 1 ) ) )
true .

?- solve(numbers(3,3,3,3,3),goal(3)).
Numbers = {3, 3, 3, 3, 3} Goal = 3
considering rule 6 ...
application of rule 6 produces ( 3 + ( ( 3 - 3 ) + ( 3 - 3 ) ) )
true .

?- solve(numbers(7,7,7,7,7),goal(7)).
Numbers = {7, 7, 7, 7, 7} Goal = 7
considering rule 6 ...
application of rule 6 produces ( 7 + ( ( 7 - 7 ) + ( 7 - 7 ) ) )
true .
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% H7
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situation7 :-
        problem(numbers(N1,N2,N3,N4,N5),goal(G)),
        perm(s(N1,N2,N3,N4,N5),p(A,B,C,D,E)),
        twoP(A,B),
        zeroP(C,D),
        TwoLess is E - 2,
        G = TwoLess,
        defTemp(A,B,C,D,E).
action7 :-
        temp(A,B,C,D,E),
        zeroX(C,D,ZeroX),
        twoX(B,A,TwoX),
        assert(solution(ex(E,-,ex(TwoX,+,ZeroX)))).

?- solve(numbers(2,2,3,5,9),goal(7)).
Numbers = {2, 2, 3, 5, 9} Goal = 7
considering rule 7 ...
application of rule 7 produces ( 9 - ( ( 5 - 3 ) + ( 2 - 2 ) ) )
true .

?- solve(numbers(5,5,7,9,7),goal(5)).
Numbers = {5, 5, 7, 9, 7} Goal = 5
considering rule 7 ...
application of rule 7 produces ( 7 - ( ( 9 - 7 ) + ( 5 - 5 ) ) )
true .

?- solve(numbers(5,7,4,8,8),goal(2)).
Numbers = {5, 7, 4, 8, 8} Goal = 2
considering rule 7 ...
application of rule 7 produces ( 4 - ( ( 7 - 5 ) + ( 8 - 8 ) ) )
true
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% H8
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situation8 :-
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        problem(numbers(N1,N2,N3,N4,N5),goal(G)),
        perm(s(N1,N2,N3,N4,N5),p(A,B,C,D,E)),
        A=B,
        C=D,
        TwoLess is E - 2,
        G = TwoLess,
        defTemp(A,B,C,D,E).
action8 :-
        temp(A,B,C,D,E),
        assert(solution(ex(E,-,ex(ex(A,/,B),+,ex(C,/,D))))).

?- solve(numbers(2,2,4,4,9),goal(7)).
Numbers = {2, 2, 4, 4, 9} Goal = 7
considering rule 8 ...
application of rule 8 produces ( 9 - ( ( 2 / 2 ) + ( 4 / 4 ) ) )
true .

?- solve(numbers(5,5,7,7,3),goal(1)).
Numbers = {5, 5, 7, 7, 3} Goal = 1
considering rule 8 ...
application of rule 8 produces ( 3 - ( ( 5 / 5 ) + ( 7 / 7 ) ) )
true .

?- solve(numbers(6,3,8,3,8),goal(4)).
Numbers = {6, 3, 8, 3, 8} Goal = 4
considering rule 8 ...
application of rule 8 produces ( 6 - ( ( 3 / 3 ) + ( 8 / 8 ) ) )
true .
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