1. (a) S'={1,2,3}
   S={7}

   (b) S'={1}
   S={1000}

   (c) To find an optimal solution using genetic algorithms and bit strings you would be best off adding together the subsets to get the sum of that number in the subset. You would then convert the sum to binary and compare the subsets using the binary genetic algorithm.

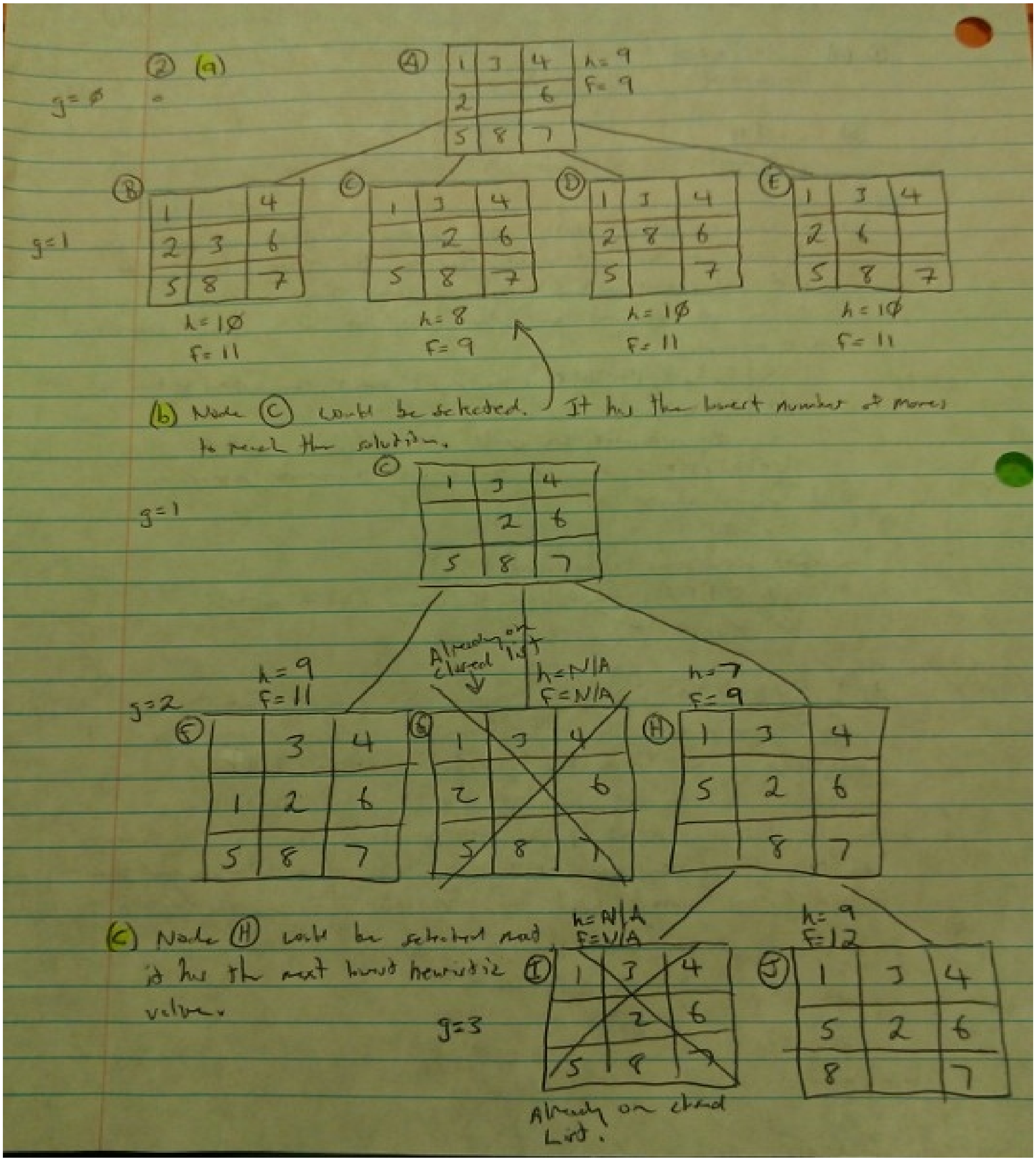
   For example:
   S={3,5,8,14,30} is the original subset, the optimal solution is:
   S'={3,5,8,14}

   To make this verifiable we would add the subset together. 3+5+8+14 = 30 and do the same for the numbers in the original subset 30=30.
   Convert both subsets to binary...

   S= 30 → 11110
   S'= 30 → 11110 Both are the same so the solution works!

   (d) To calculate the fitness the program would have to generate its subsets and convert them to binary in the same manner that is described above. Once this is done, the fitness will need to be calculated. The simplest way to do this would be a comparison of the two bit strings bit by bit. For each bit that matches between the two strings, one point will be added to the fitness and the highest fitness number would be considered the optimal solution.

2.


(2) (a)
g=Ø
A
h=9
F=9
g=1
B
C
D
E
h=1Ø
F=11
h=8
F=9
h=1Ø
F=11
h=1Ø
F=11
(b) Node (C) would be selected. It has the lowest number of moves to reach the solution.
C
g=1
g=2
F
G
H
h=9
F=11
Already on closed list
h=N/A
F=N/A
h=7
F=9
(c) Node (H) would be selected next as it has the next lowest heuristic value.
h=N/A
F=N/A
I
g=3
h=9
F=12
J
Already on closed List.

3. (a) To get an output of -1, x and y will have to be the following:
   x = -1
   y = 2

   (b) To get an output of 1, x and y will have to be the following:
   x = 4
   y = 3

   (c) w1 = 3
   w'1 = 3 + .5(1+1) -1 = -4
   w'1 = -4
   w2 = -1
   w'2 = -1 + .5(1+1) 0 = 0
   w'2 = 0

4. (a) under(X,Y) :-
   on(X,Y).

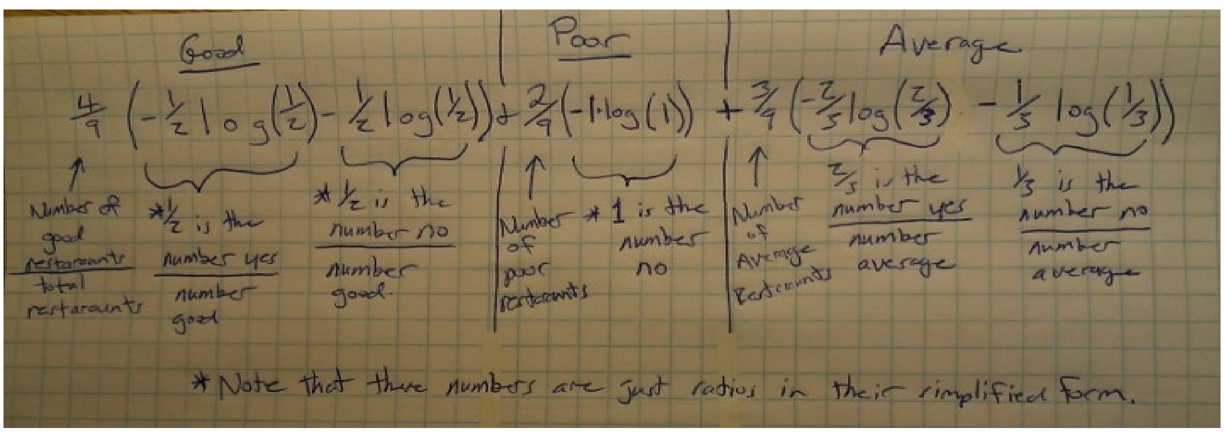
   (b) second(X) :-
   on(X,Y),
   on(Y,Z).

   (c) third (X) :-
   on(X,Y),
   on(Y,Z),
   on(Z,A).

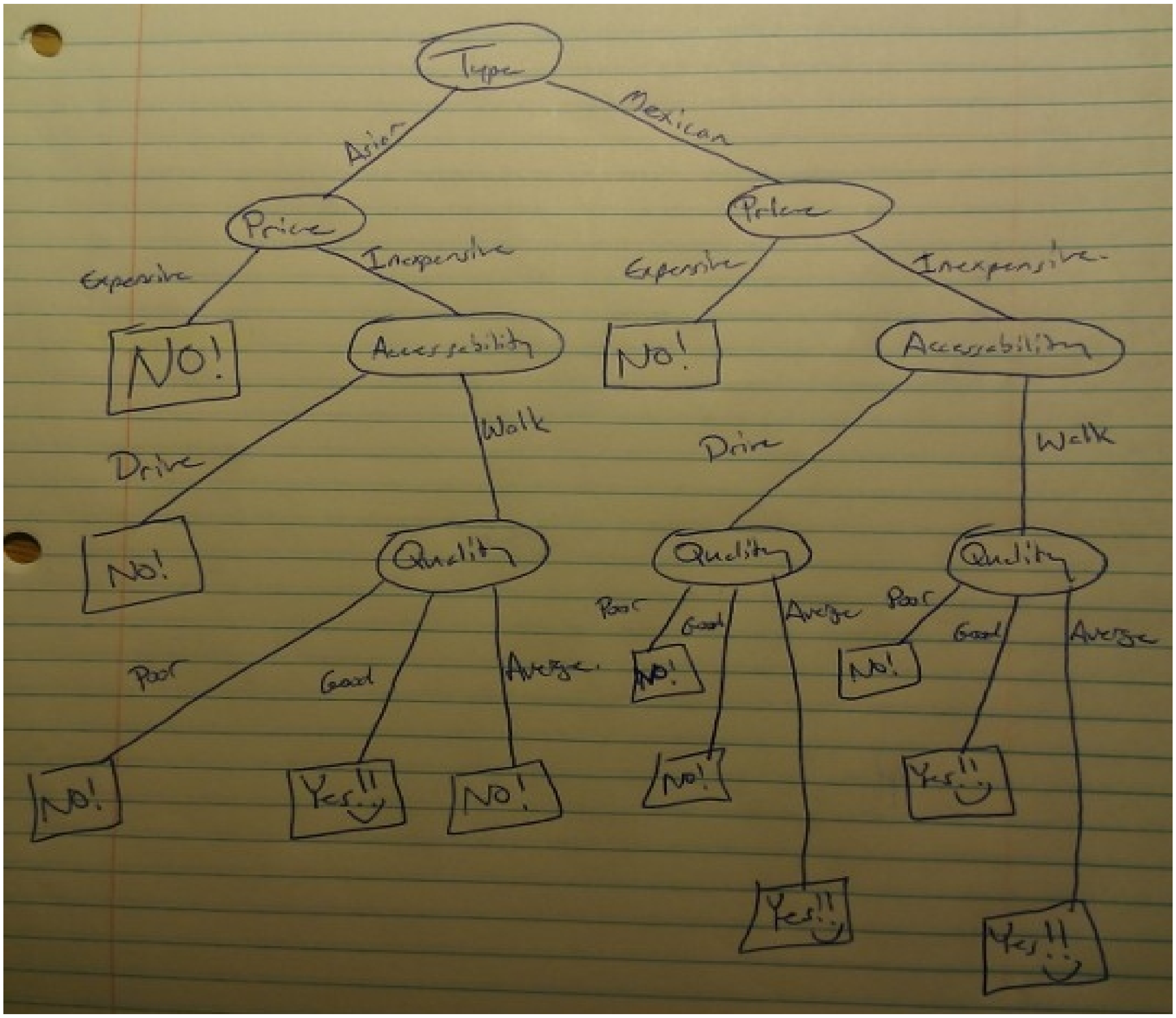
5. After the hopfield network "settles down" into a stable state I would expect the values at the six nodes to be **(-1, -1, -1, 1, 1, 1)**.

6. (a) After tabulating which category predicted whether or not the person would eat at the restaurant it turned out that the price was the biggest factor. In 4 out of 5 cases where the good was inexpensive the student ate there. Not once did the student eat at an expensive restaurant.

   (b)

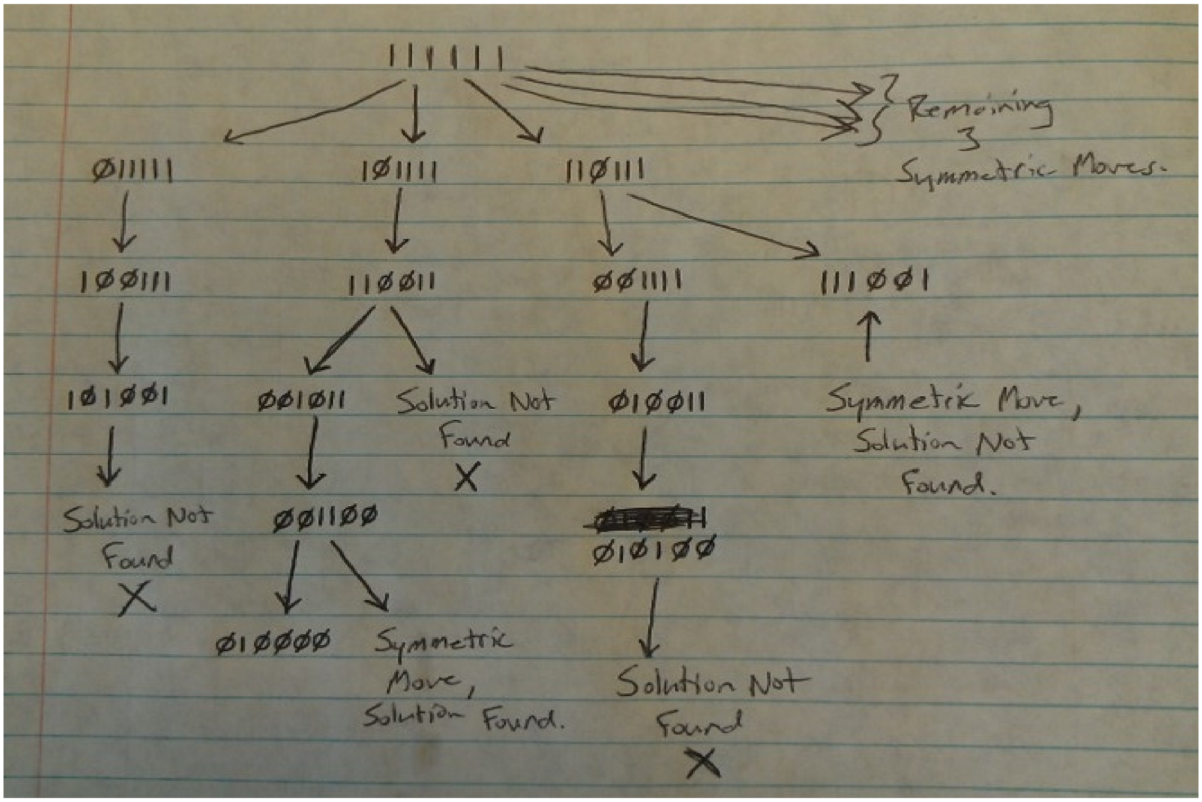


(c)

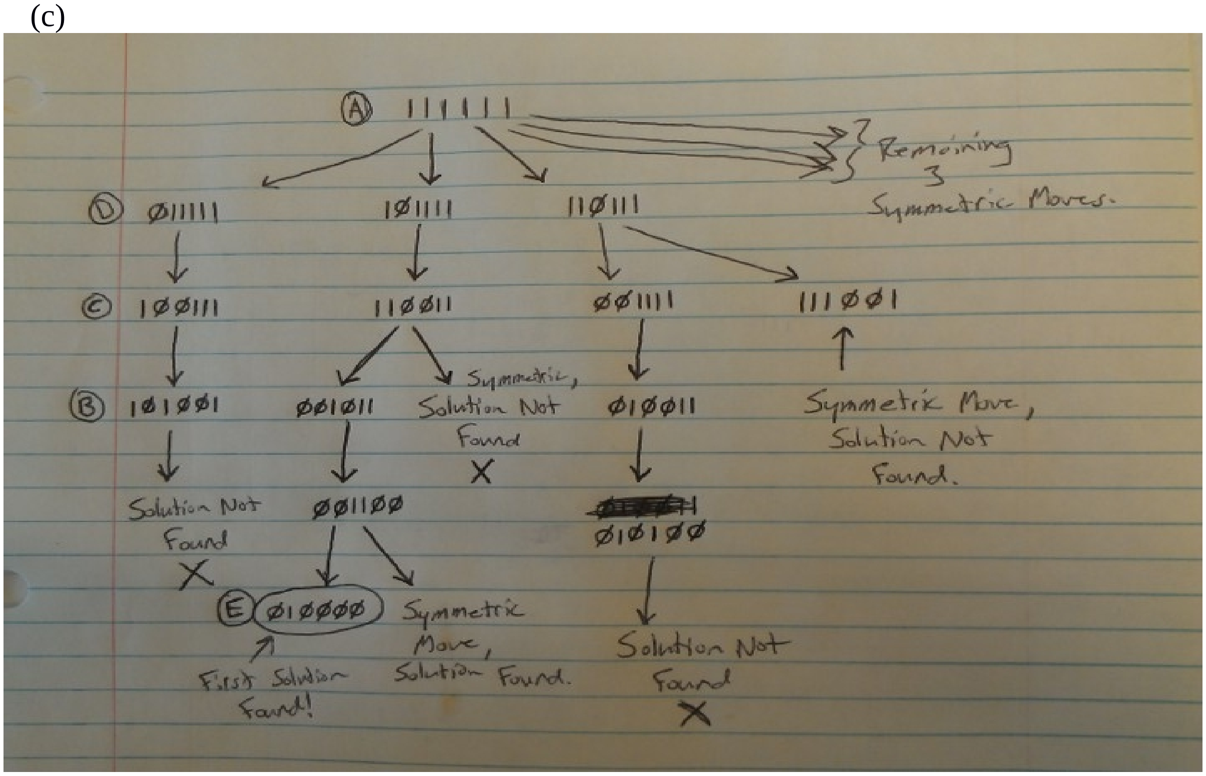


7. (a) The number of moves necessary can be reduced by using symmetry. If you find a solution, you can assume, that due to the game being symmetric, if you do the same exact same thing mirrored over the line of symmetry it will come out to the same conclusion.

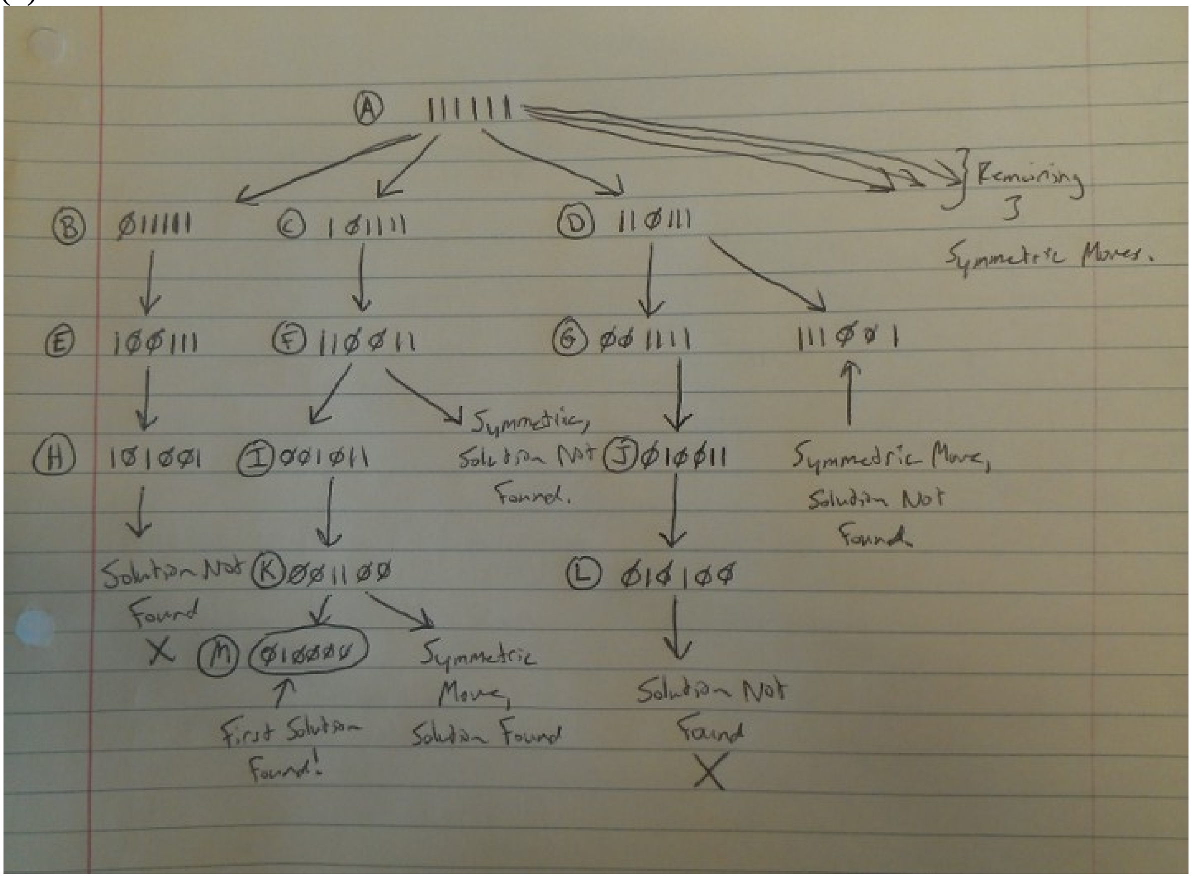
(b)


111111
Remaining 3 Symmetric Moves.
Ø11111
1Ø1111
11Ø111
1ØØ111
11ØØ11
ØØ1111
111ØØ1
1Ø1ØØ1
ØØ1Ø11
Solution Not Found
Ø1ØØ11
Symmetric Move, Solution Not Found.
Solution Not Found
ØØ11ØØ
Ø1Ø1ØØ
Ø1ØØØØ
Symmetric Move, Solution Found.
Solution Not Found

(c)

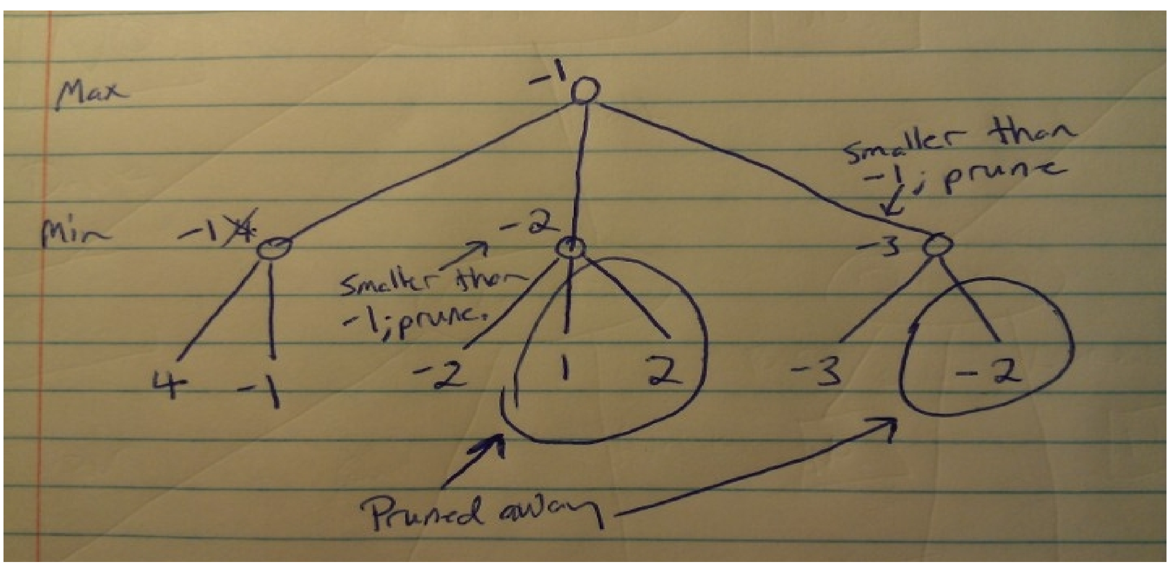

A 111111
Remaining 3 Symmetric Moves.
D Ø11111
1Ø1111
11Ø111
C 1ØØ111
11ØØ11
ØØ1111
111ØØ1
B 1Ø1ØØ1
ØØ1Ø11
Symmetric, Solution Not Found
Ø1ØØ11
Symmetric Move, Solution Not Found.
Solution Not Found
ØØ11ØØ
Ø1Ø1ØØ
E Ø1ØØØØ
Symmetric Move, Solution Found.
First Solution Found!
Solution Not Found

(d)

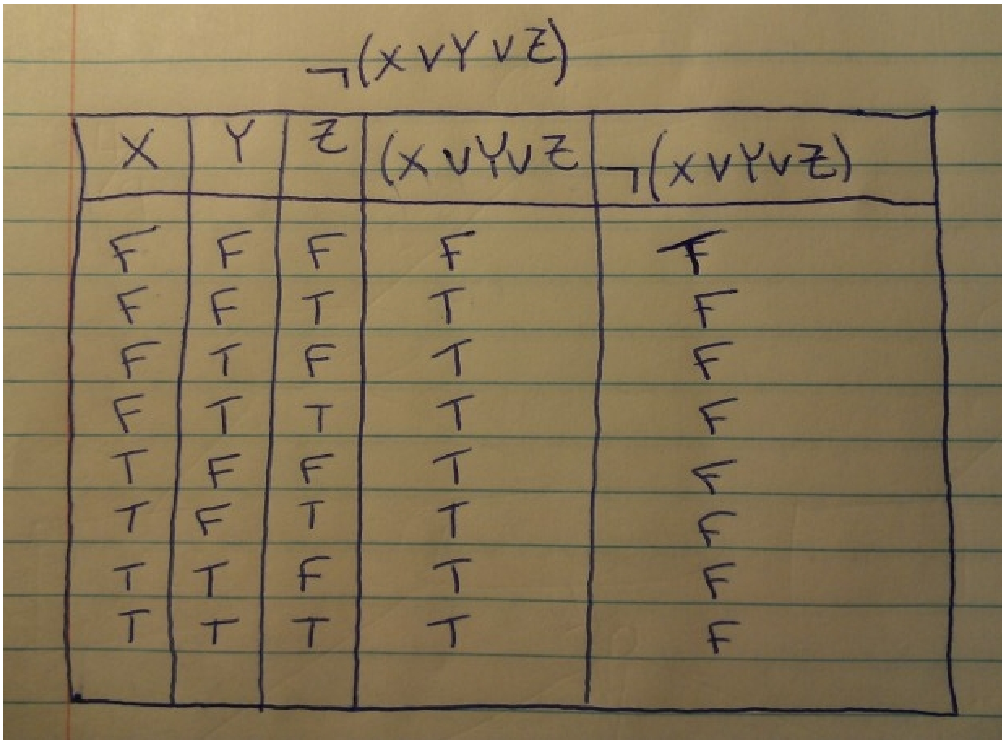


8. (a) The best achievable value for player 1, assuming player 2 plays optimally is -1.

(b)

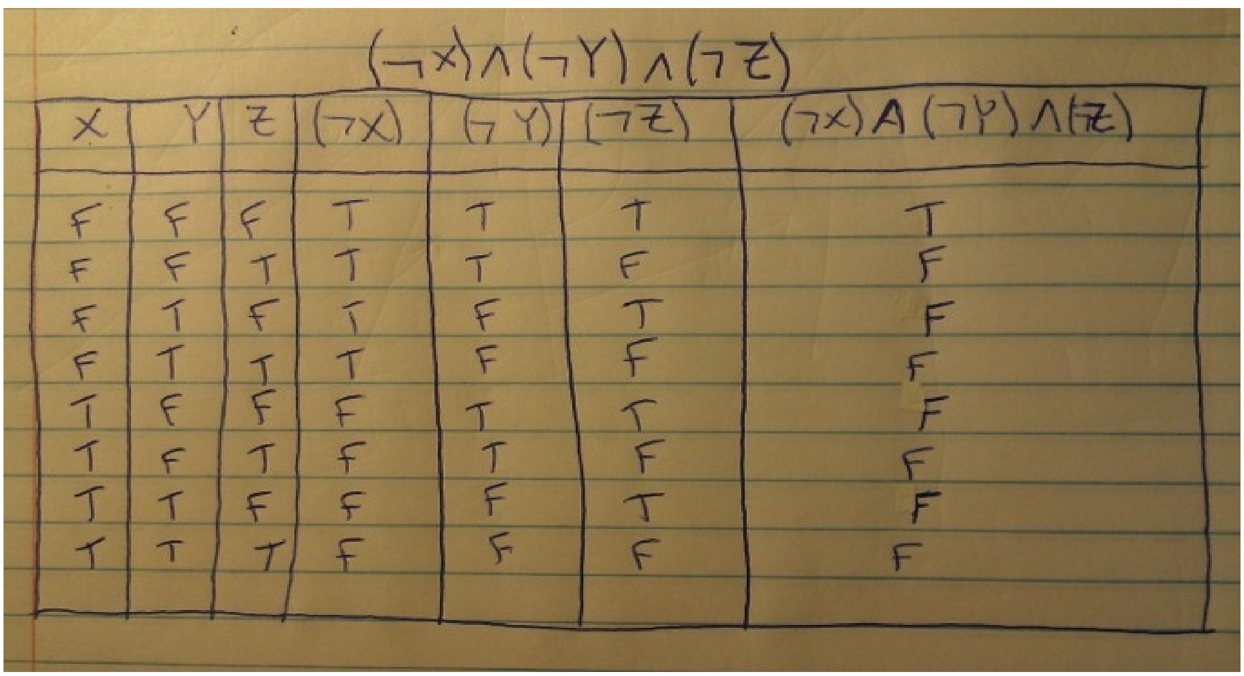


9. Both of the final columns in the truth tables are identical, therefore both logic expressions are equal.



$\neg(X \vee Y \vee Z)$

X	Y	Z	$(X \vee Y \vee Z$	$\neg(X \vee Y \vee Z)$
F	F	F	F	F
F	F	T	T	F
F	T	F	T	F
F	T	T	T	F
T	F	F	T	F
T	F	T	T	F
T	T	F	T	F
T	T	T	T	F



$(\neg X) \wedge (\neg Y) \wedge (\neg Z)$

X	Y	Z	$(\neg X)$	$(\neg Y)$	$(\neg Z)$	$(\neg X) \wedge (\neg Y) \wedge (\neg Z)$
F	F	F	T	T	T	T
F	F	T	T	T	F	F
F	T	F	T	F	T	F
F	T	T	T	F	F	F
T	F	F	F	T	T	F
T	F	T	F	T	F	F
T	T	F	F	F	T	F
T	T	T	F	F	F	F

10. (a) f (X, p(q(Y)), Z) + f (A, B, C) = f(X, p(B), Z)
    (b) f (X, p(q(Y)), Z) + f (p(R), p(S), p(T)) = f(p(X), p(p(S)), p(Z))
    (c) f (a, b, c) can't be unified with the original logic function because it uses constants.
    (d) f (p(a), p(q(M)), N) can't be unified because it uses a mix of variables and constants and the constant can't be unified with a variable because variables have changing values.

11. Artificial Intelligence is the branch of computer science that is concerned with the automation of intelligent behavior.