AI HW2

1a)

Limit 1: S
Limit 2: S -> a -> b -> c
Limit 3: S -> a -> d -> G_2

The path solution is therefore S –> a -> d -> G_2

This is not the optimal path as the shortest traversal to the goal state is s -> b -> G_1

1b)

A heuristic h(n) is admissible if for every node n, h(n) <= h*(n) where h*(n) is the true cost to reach the goal from n.
If we n = a, then the true cost to the shortest goal G_2 is 2. Therefore h <= 2 for the function to be admissible.
To make the overall heuristic function admissible, h = 0, 1, 2

Consistency: h(a) – h(n) <= actual cost(a to n) where n represents any successor node from a, and h(n) represents the estimated cost of reaching the goal state from n.

h(a) <= actual cost(a to G_2) + h(G_2) → h(a) <= 2 + 0
h(a) <= actual cost(a to d) + h(d) -> h(a) <= 1 + 0

Therefore, h(a) = 0, 1 to satisfy the conditions for the function to be consistent.

1c)

Node	F = g + h
~~S~~	4 = 0 + 4
~~b~~	4 = 2 + 2
~~a~~	3 = 3 + 0
c	6 = 6 + 0
d	5 = 4 + 1
G_2	5 = 5 + 0
~~G_1~~	4 = 4 + 0

Expanded Nodes:
1. S
2. S -> A
3. S -> A -> B
4. S -> A -> B -> G_1

The path solution is S -> B -> G_1 which is the optimal path as when h = 0 the function is both admissible and heuristic which suggests optimality.

2a)

Variables: X = {G, O, T, U}
Domains: D_i = {0, …, 9}
Constraints:

- Unary: G $= \{1, \ldots, 9\}$, T $= \{1, \ldots, 9\}$, O $= \{1\}$

2b)

The LCV assignment to the MRV variable would be O = 1
Binary Constraint:

- T = O + O = 2O

Global Constraints:

- Alldiff(X_i)

Nodes	O	T	G	U
Domain	1	{2}	{2, …, 9}	{0, 2, …, 9}

2c)

The LCV assignment to the MRV variable would be T = 2 as that is the only domain possible under the current unary constraints.

Nodes	O	T	G	U
Domain	1	2	{2, … , 9}	{0, 2, … 9}

2d)

G >= 10 – T
U = (G + T % 10)

Constraints:

- T = 2O , G + T = OU >= 10
- Global: Alldiff(X_i)

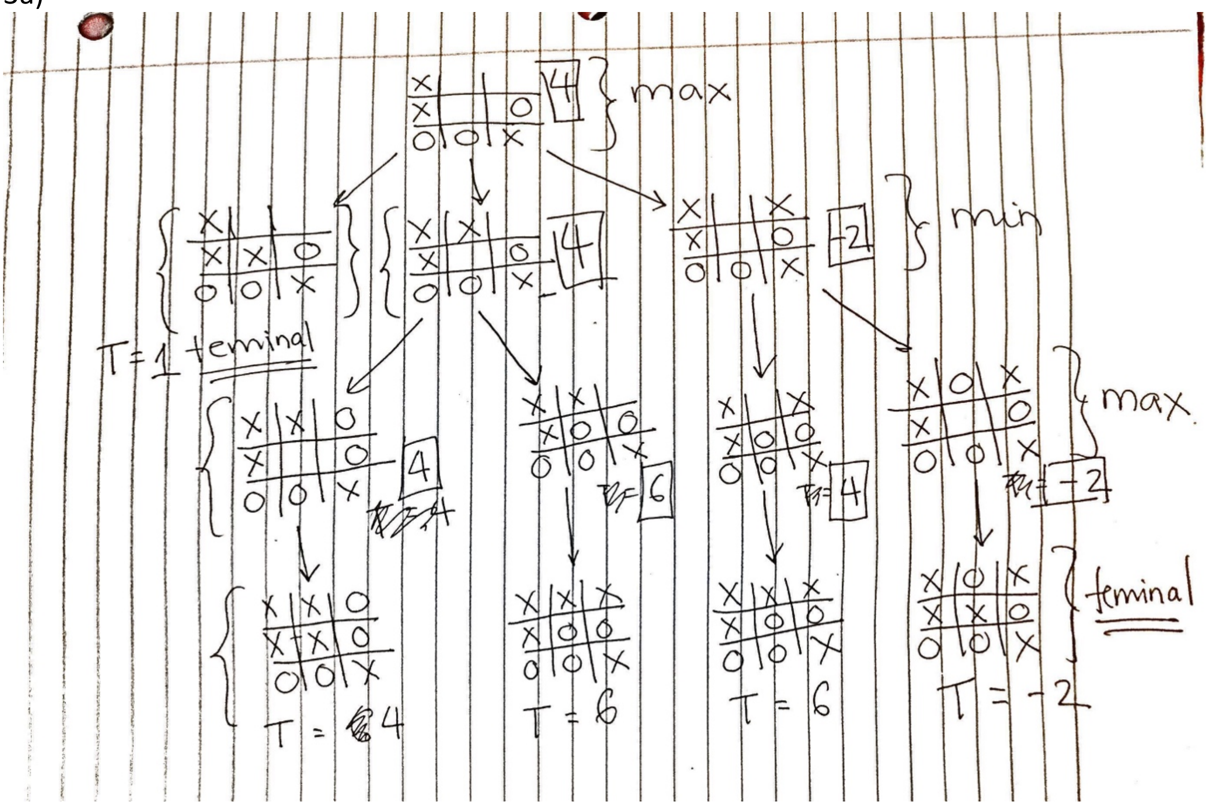
If we know that T = 2
Therefore: G >= 10 – 2 >= 8

Therefore G = {8, 9}

If G = 8 → U = (8 + 2 % 10) = 0, or if G = 9 → U = (9 + 2 % 10) = 1
U = {0, 1}

O = 1, T = 2, G = {8, 9}, U = {0, 1}

3a)



3b)

The best action for x to take is to compute the board:

X	X	
X		O
O	O	X

The expected score therefore at the end of the game would be **4** if all players played rationally.