INTELLIGENT DECISION SUPPORT SYSTEMS – EXERCISES IV – CONGESTION AND EXTENSIVE GAMES

I. Indicate the truth (T) or falsity (F) for the below statements.

a) Every congestion game has at least one pure Nash equilibrium
b) The matching pennies games is not a potential game
c) It is not guaranteed that each potential game has at least one pure Nash equilibrium
d) Every congestion game is a potential game
e) An action profile that does not admit a better response is a pure Nash equilibrium
f) Every congestion game has the finite improvement property
g) Every normal-form game has at least one Nash equilibrium
h) The definition of An extensive-form game involves, e.g., a set of choice nodes, the turn function, and the successor function
i) Every norm-form game can be translated into an extensive-form game
j) Every finite extensive-form game has at least one pure Nash equilibrium
k) The backward induction was originally proposed in the context of tic-tac-toe
l) Every finite extensive-form game has at least one subgame-perfect equilibrium
m) The vackward induction does not guarantee finding a subgame-perfect equilibrium

II. Consider the below strategic games involving two payers, A and B. Are they potential games? If so, define the underlying potential function with P(T,L) = 10.

A \ B	L	R
T	2 \ 2	1 \ 1
B	3 \ 0	1 \ 1

A \ B	L	R
T	2 \ 2	1 \ 1
B	3 \ 0	1 \ 1

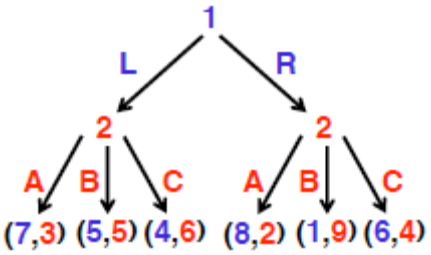
III. Consider the below strategic game involving two payers, A and B. Does it have a finite improvement property? If so, identify a pure Nash equilibrium through better response dynamics (mark the path in the table starting in the top-left cell).

A \ B	L	C	R
T	2 \ 1	1 \ 3	4 \ 4
B	0 \ 0	2 \ 1	3 \ 3

IV. Consider the following congestion game: 5 people need to get from A to B. Everyone can choose between the top and the bottom route. Via the top route, the trip takes 5 minutes (in the other scenario, consider – 6 minutes). Via the bottom route, it depends on the number of fellow travelers: it takes as many minutes x as there are people using this route.

a) Define the underlying congestion game (players, resources, action space, delay functions).
b) What are the pure Nash equilibria? Please explain.
c) What is the price of anarchy?

IV. Consider the below presented extensive game involving two players, 1 and 2.



a) Find a pure Nash equilibrium using the backward induction.

b) Is (L, C-B) the only Nash equilibrium?

c) Is (L, C-C) a subgame perfect-equilibrium?

d) Transtorm the extensive game to the normal-form game.

V. Consider the below presented centipede game and find a pure Nash equilibrium using a backward induction/