1. Functions in Lua

(a) Write a function in Lua that doubles the value of another function.

(b) Write a function in Lua that finds the first derivative of another function.

2. Game of Life

Implement Conway's Game of Life in LUA. See definition of "Game of Life" in the Wikipedia.

3. Hobbesian state of nature

Implement the "hawk, dove, law abiding" model for competition between resources:

(a) A dove never tries to get hold of others' possessions, but waits until they are given up, and himself abandons his resource as soon as he is attacked. If two compete for the same resource, one of them gets it with equal probability.

(b) The hawk always tries to get hold of others' resources by means of aggression and gives up only if he receives serious injuries.

(c) The law-abider never tries to get hold of others' resources, but waits until they are given up, and he defends his possession by counterattack until he either succeeds or is defeated.

Further details are given in the paper, "A bioeconomic model of Hobbes' state of nature", by Juan Carlos Martinez Coll, *Social Science Information* 1986; 25; 493 (attached).

4. Iterated Prisioner's Dillema

You and a friend have committed a crime and have been caught. You are being held in separate cells. You are both offered a deal but have to decide what to do. But you are not allowed to communicate with your partner and you will not be told what they have decided until you have made a decision. Essentially the deal is this:

a. If you confess and your partner denies taking part in the crime, you go free and your partner goes to prison for ten years.

b. If your partner confesses and you deny participating in the crime, you go to prison for ten years and your partner goes free.

c. If you both confess you will serve five years each.

d. If you both deny taking part in the crime, you both serve six months.

	Prisoner B Stays Silent	Prisoner B Betrays
Prisoner A Stays Silent	Each serves six months	Prisoner A serves ten years Prisoner B goes free
Prisoner A Betrays	Prisoner A goes free Prisoner B serves ten years	Each serves five years

In game theory, the **prisoner's dilemma** (sometimes abbreviated PD) is a type of non-zero-sum game in which two players may each "cooperate" with or "defect" (i.e. betray) the other player. In this game, as in all game theory, the only concern of each individual player ("prisoner") is maximizing his/her own payoff, without any concern for the other player's payoff. Since in any situation playing defect is more beneficial than cooperating, all rational players will play defect, all things being equal.

In the **iterated prisoner's dilemma** the game is played repeatedly. Thus each player has an opportunity to "punish" the other player for previous non-cooperative play. Cooperation may then arise as an equilibrium outcome. The incentive to defect is overcome by the threat of punishment, leading to the possibility of a cooperative outcome.

Implement the **iterated prisoner's dilemma in LUA** with at least three strategies and compare the results of different strategies.