Report: Boolean Regulatory Network

Boolean Network Class:

Here are all perameters in this class:

```
int numberOfCells;
Number of cells in the grid

int connectivityDegree;
2: Orthogonal signaling    4: Symmetric signaling

int numberOfNodes;
Number of genes in each cell

int numberOfInput;
Number of input to each node
1: ordered   2: critical    3:chaotic

int commBandwidth;
Number of nodes in each cell, which send signal to their
neighbors

int X;
int Y;
Dimensions of the grid of cells

int [][] connGraph;
A two dimensional matrix of [number of cells][degree of
connectivity]
For orthogonal signaling, degree of connectivity is 2 and for
symmetric it is 4. When a cell (4) receive signal from its North
(5) and West (6) neighbor, the values of 5 and 6 store the fourth
raw of the matrix.

boolean [][][] networkWiring;
A three dimensional array of [number of nodes][degree of
connectivity + 1][number of nodes]
It stores the wiring of inter- and intra- cellular network. In
fact, It has a two dimensional matrix for each node (gene) which
shows the connections between that node with all other nodes in
the cell and outside of the cell. The first row of this matrix
stores the inputs from internal modes and the remaining rows are
```

for inputs from external signaling.

For example, if node 1 has inputs from node 2 and node 3 from its cell, true will store in these spaces:
networkWiring[1][0][2] = networkWiring[1][0][3] true; //0: first raw

For inter cellular signaling, if node 4 receive signals from node 2 in its North neighbor and from node 5 in its East neighbor,true will store in these spaces:
networkWiring[4][1][2] = true; //1: North neighbor
networkWiring[4][2][5] = true; //2: East neighbor

```
private boolean [][] truthTable;
```
Matrix of [number of nodes][number of inputs to each node]
Boolean functions for intracellular network store here. It generates randomly with the probability of 0.5 for false and true.

```
private boolean [][] truthTable_inter;
```
Matrix of [number of nodes][degree of connectivity]
Boolean function for intercellular network. The OR result of all receiving signals and internal value of the node.

```
ArrayList<ArrayList<Integer>> sameAttractors;
```
List of cells, which are in the same attractors

```
ArrayList<ArrayList<Integer>> allAttractors;
```
List of all attractors in the grid

```
int time;
```
Current time of the system

```
boolean [][][] stateSlate;
```
Array of [number of cells][2][number of nodes]
It stores the last two states of all nodes in all cells

```
Hashtable<Integer, Integer> [] cellStates;
```
Table of all states of all cells

Methods:

`init_connGraph()`

Fill the connGraph based on the orthogonal or symmetric signaling

`randomNet()`

Randomly intialize networkWiring, truthTable, truthTable_inter

`update(int itr)`

Update states all cells for ‘itr’ iterations

`updateOnce(int cell)`

Update the state of a cell once

`indexInTruthTable(int cell, int func)`

Find the corresponding index in TruthTable for a node(‘func’) in a cell(‘cell’)

`indexInTruthTable_inrta(int cell, int func, boolean internal)`

Find the corresponding index in TruthTable for a node(‘func’) with specific internal value (‘internal’) in a cell(‘cell’)

`findCellsOfSameAttractors()`

Find cells in the same attractors

`findAttractors(int cell)`

Find attractors of a cell (‘cell’)

```
initializeCellsRandomly()

Randomly initialize all nodes in all cells
```