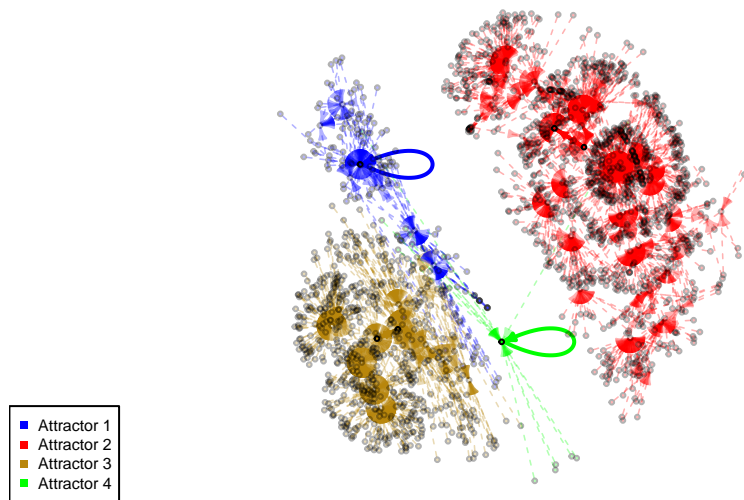


Analyzing a hematopoietic genetic network

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```
attr <- getAttractors(HSC)
plotStateGraph(attr)
```



```
print(attr)
```

```
## Attractor 1 is a simple attractor consisting of 1 state(s) and has a basin of 134 state(s):
##
## |--<-----|
## V          |
## 0000000000  |
## V          |
## |-->-----|
##
```

```

##
## Genes are encoded in the following order: Erg Eto2 Fli1 Gata1 Gata2 Hhex Pu1 Runx1 Scl Smad6 Zfp1
##
## Attractor 2 is a simple attractor consisting of 1 state(s) and has a basin of 16 state(s):
##
## |--<-----|
## V          |
## 00010000100 |
## V          |
## |-->-----|
##
##
## Genes are encoded in the following order: Erg Eto2 Fli1 Gata1 Gata2 Hhex Pu1 Runx1 Scl Smad6 Zfp1
##
## Attractor 3 is a simple attractor consisting of 2 state(s) and has a basin of 1258 state(s):
##
## |--<-----|
## V          |
## 00101111110 |
## 11100110111 |
## V          |
## |-->-----|
##
##
## Genes are encoded in the following order: Erg Eto2 Fli1 Gata1 Gata2 Hhex Pu1 Runx1 Scl Smad6 Zfp1
##
## Attractor 4 is a simple attractor consisting of 2 state(s) and has a basin of 640 state(s):
##
## |--<-----|
## V          |
## 00101110110 |
## 11100111111 |
## V          |
## |-->-----|
##
##
## Genes are encoded in the following order: Erg Eto2 Fli1 Gata1 Gata2 Hhex Pu1 Runx1 Scl Smad6 Zfp1

```

Attractor 4 is the one that is closest to the experimental HSPC expression profile 1110111111 - 1110011111(Attractor 4)

```

attr <- getAttractors(HSC, type="asynchronous",
method="random", startStates=500)
print(attr)

```

```

## Attractor 1 is a simple attractor consisting of 1 state(s):
##
## |--<-----|
## V          |
## 00010000100 |
## V          |
## |-->-----|
##
##

```

```

##
## Genes are encoded in the following order: Erg Eto2 Fli1 Gata1 Gata2 Hhex Pu1 Runx1 Scl Smad6 Zfp1
##
## Attractor 2 is a simple attractor consisting of 1 state(s):
##
## |--<-----|
## V          |
## 0000000000  |
## V          |
## |-->-----|
##
##
## Genes are encoded in the following order: Erg Eto2 Fli1 Gata1 Gata2 Hhex Pu1 Runx1 Scl Smad6 Zfp1
##
## Attractor 3 is a complex/loose attractor consisting of 32 state(s) and 112 transition(s):
##
## 1110111111 => 1110111011
## 1110111111 => 1110011111
## 1110111111 => 0110111111
## 0110111111 => 0110111011
## 0110111111 => 0110011111
## 1010111111 => 1010111011
## 1010111111 => 1010011111
## 1010111111 => 1110111111
## 0010111111 => 0010111011
## 0010111111 => 0010011111
## 0010111111 => 0110111111
## 0010111111 => 1010111111
## 1110011111 => 1110011110
## 1110011111 => 1110011011
## 1110011111 => 1110111111
## 1110011111 => 1010011111
## 1110011111 => 0110011111
## 0110011111 => 0110011110
## 0110011111 => 0110011011
## 0110011111 => 0110111111
## 0110011111 => 0010011111
## 1010011111 => 1010011110
## 1010011111 => 1010011011
## 1010011111 => 1010111111
## 0010011111 => 0010011110
## 0010011111 => 0010011011
## 0010011111 => 0010111111
## 0010011111 => 1010011111
## 1110111011 => 1110111111
## 1110111011 => 1110011011
## 1110111011 => 0110111011
## 0110111011 => 0110111111
## 0110111011 => 0110011011
## 1010111011 => 1010111111
## 1010111011 => 1010011011
## 1010111011 => 1110111011
## 0010111011 => 0010111111
## 0010111011 => 0010011011

```

```

## 00101110111 => 01101110111
## 00101110111 => 10101110111
## 11100110111 => 11100110110
## 11100110111 => 11100111111
## 11100110111 => 11101110111
## 11100110111 => 10100110111
## 11100110111 => 01100110111
## 01100110111 => 01100110110
## 01100110111 => 01100111111
## 01100110111 => 01101110111
## 01100110111 => 00100110111
## 10100110111 => 10100110110
## 10100110111 => 10100111111
## 10100110111 => 10101110111
## 00100110111 => 00100110110
## 00100110111 => 00100111111
## 00100110111 => 00101110111
## 00100110111 => 10100110111
## 11101111110 => 11101111111
## 11101111110 => 11101110110
## 11101111110 => 11100111110
## 11101111110 => 01101111110
## 01101111110 => 01101111111
## 01101111110 => 01101110110
## 01101111110 => 01100111110
## 10101111110 => 10101111111
## 10101111110 => 10101110110
## 10101111110 => 10100111110
## 10101111110 => 11101111110
## 00101111110 => 00101111111
## 00101111110 => 00101110110
## 00101111110 => 00100111110
## 00101111110 => 01101111110
## 00101111110 => 10101111110
## 11100111110 => 11100110110
## 11100111110 => 11101111110
## 11100111110 => 10100111110
## 11100111110 => 01100111110
## 01100111110 => 01100110110
## 01100111110 => 01101111110
## 01100111110 => 00100111110
## 10100111110 => 10100110110
## 10100111110 => 10101111110
## 00100111110 => 00100110110
## 00100111110 => 00101111110
## 00100111110 => 10100111110
## 11101110110 => 11101110111
## 11101110110 => 11101111110
## 11101110110 => 11100110110
## 11101110110 => 01101110110
## 01101110110 => 01101110111
## 01101110110 => 01101111110
## 01101110110 => 01100110110
## 10101110110 => 10101110111

```

```

## 10101110110 => 10101111110
## 10101110110 => 10100110110
## 10101110110 => 11101110110
## 00101110110 => 00101110111
## 00101110110 => 00101111110
## 00101110110 => 00100110110
## 00101110110 => 01101110110
## 00101110110 => 10101110110
## 11100110110 => 11100111110
## 11100110110 => 11101110110
## 11100110110 => 10100110110
## 11100110110 => 01100110110
## 01100110110 => 01100111110
## 01100110110 => 01101110110
## 01100110110 => 00100110110
## 10100110110 => 10100111110
## 10100110110 => 10101110110
## 00100110110 => 00100111110
## 00100110110 => 00101110110
## 00100110110 => 10100110110
##
## Genes are encoded in the following order: Erg Eto2 Fli1 Gata1 Gata2 Hhex Pu1 Runx1 Scl Smad6 Zfp1

```

Task 2 : Attractor 3 appears to be an asynchronous attractor because it is a complex/loose attractor

Task 3 : The average expression per gene for the 12 individual cells is:

```

Eto2: 0.33
Fli1: 0.25
Gata1: 0.00
Gata2: 0.04
Hhex: 0.50
Pu.1: 0.33
Runx1: 0.08
Scl: 0.67
Smad6: 0.13
Zfp1: 0.42

```

and the avg activity per gene across the 32 states IS : Erg : 0.5

```

Eto2: 0.5
Fli1: 1
Gata1: 0
Gata2: 0.5
Hhex: 1
Pu.1: 1
Runx1: 0.5
Scl: 1
Smad6: 1
Zfp1: 0.5

```

We concluded that the avg activities per gene were not similar except for the Gata1.

```

pdf("RBNS.pdf")
for(i in 1:10){ #initiating a loop
net<-generateRandomNKNetwork(n=10, k=i) # generating random networks with n=10 genes and each gene having
plotNetworkWiring(net, main=i) #Plotting the network with title i
}

```

```
attr <- getAttractors(net) # getting the number of attractors and attributing it to the variable attr
plotStateGraph(attr, main=i) #plotting the attractors with i being the title
}
dev.off("RBNs.pdf") # closes the pdf directly when it opens
```

```
## Warning in dev.off("RBNs.pdf"): NAs introduced by coercion
```

```
## pdf
## 3
```

```
pdf("Perturbations.pdf")
data(cellcycle)
attr <- getAttractors(cellcycle)
plotStateGraph(attr, main="Unperturbed network")
for(i in 1:5){
  perturbedNet <- perturbNetwork(cellcycle, perturb="functions", method="bitflip")
  attr <- getAttractors(perturbedNet)
  plotStateGraph(attr, main=i)
}
dev.off("Perturbations.pdf")
```

```
## Warning in dev.off("Perturbations.pdf"): NAs introduced by coercion
```

```
## pdf
## 4
```