

BrunoFBessa_5881890_P6_results

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0.1 SFI5904 - Complex Networks

Project 6: Dynamics of diffusion and probabilistic automata First Semester of 2021

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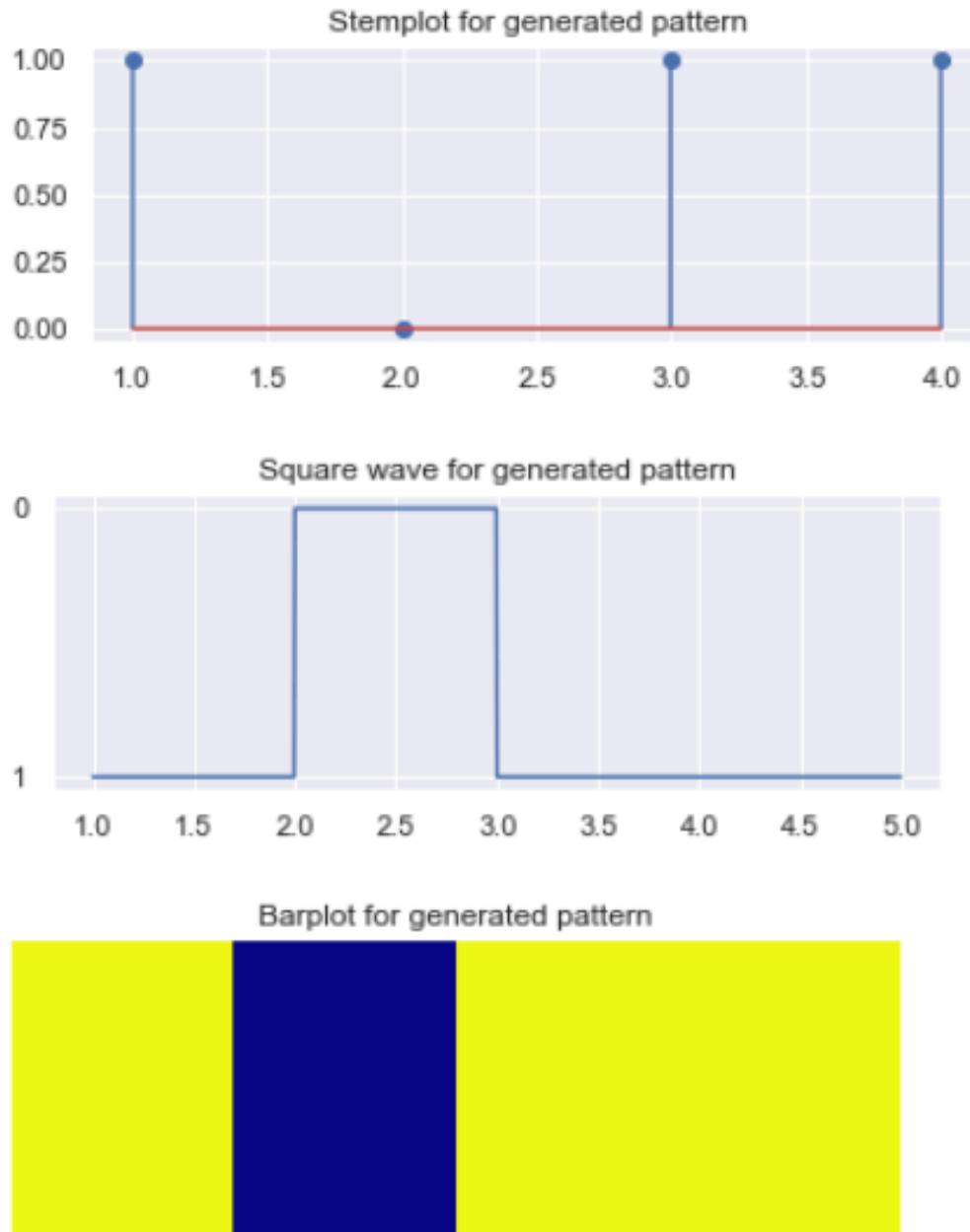
Implement all the automata analyzed in CDT-22 [1], reproduce the figures of this work.

0.2 Results

The following figures represent three alternatives of representation of a deterministic automaton with fixed transitions given by the sequence: (1, 0, 1, 1)

```
[2]: display.Image("images/deterministic_automaton_representations.png")
```

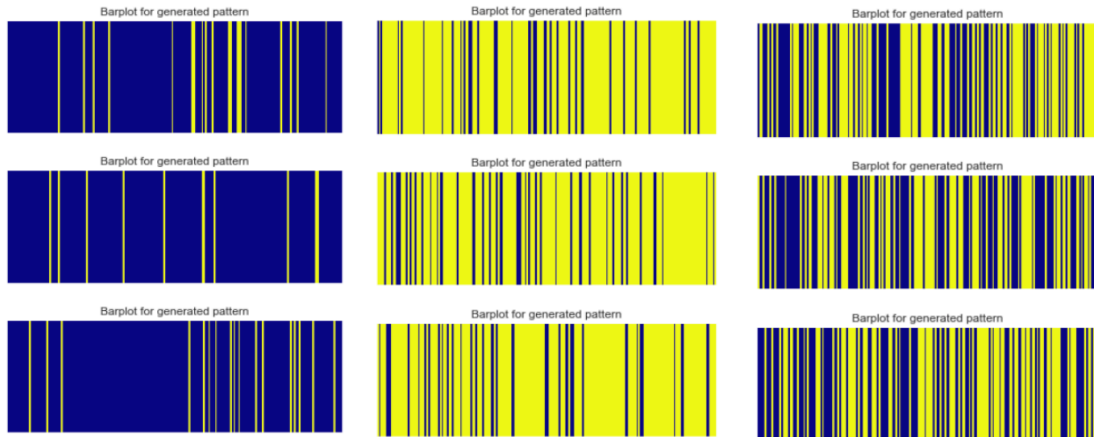
[2]:



Here we have three samples for each probabilistic pattern given in CDT-22 figure 6: a (left), b (middle), c (right).

```
[3]: display.Image("images/probabilistic_automata_patterns.png")
```

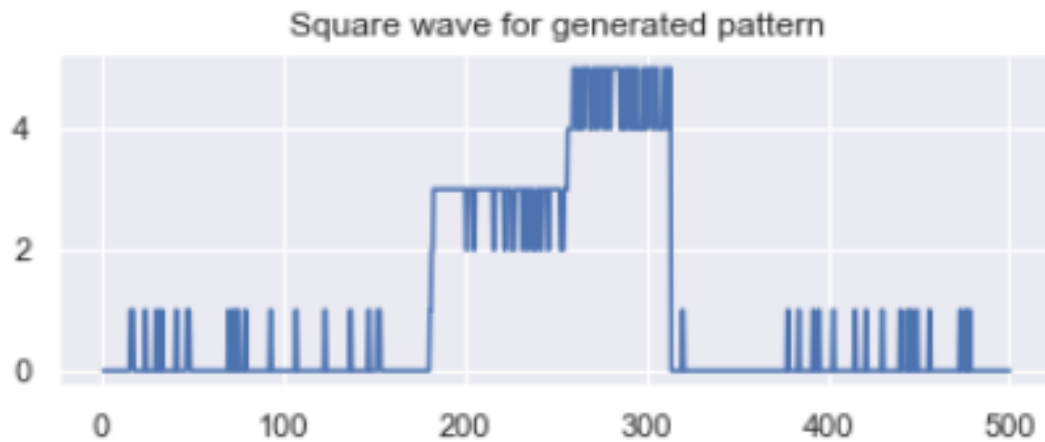
```
[3]:
```



The square wave plot below represents the probabilistic sequential automaton with more than two possible states given in CDT-22 figure 6 d.

```
[4]: display.Image("images/spa_d.png")
```

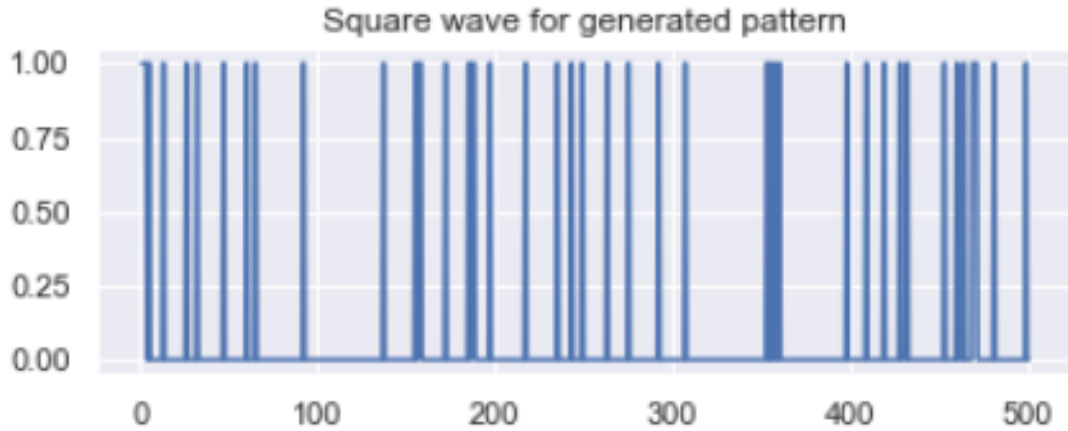
[4]:



The square wave plot resembles a barcode plot for the binary probabilistic sequential automaton of CDT22 figure 6 e:

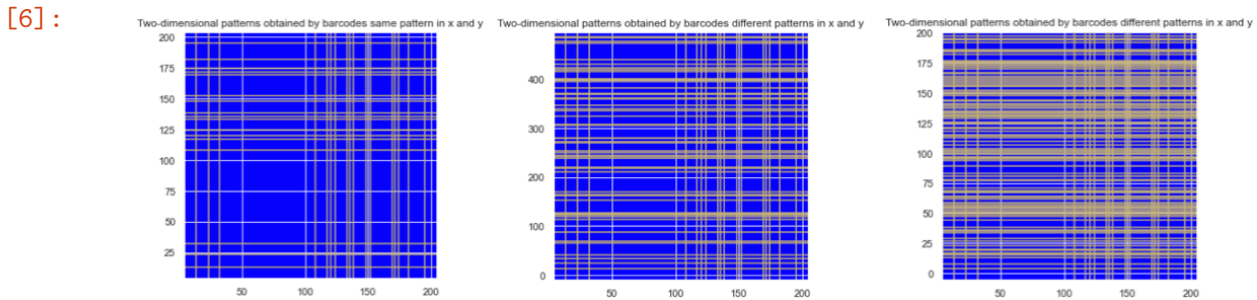
```
[5]: display.Image("images/spa_e.png")
```

[5]:



Generation of visual patterns with horizontal and vertical lines following the binary patterns, as seen in CDT-22 figure 11:

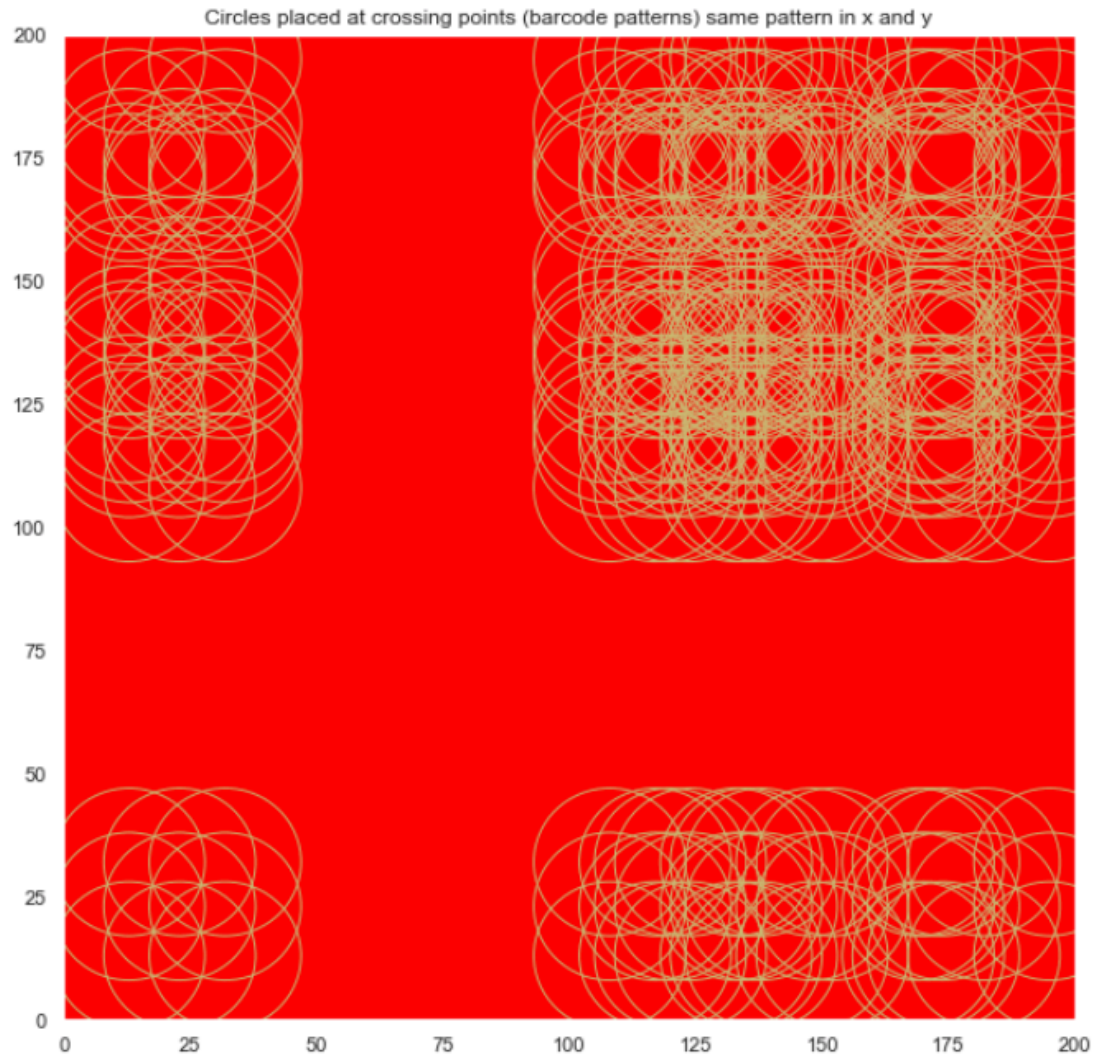
```
[6]: display.Image("images/hv_lines.png")
```



Visual pattern of circles centered at the intersection of vertical and horizontal lines created by the same binary automaton (CDT-22 figure 12):

```
[7]: display.Image("images/circles_centered.png")
```

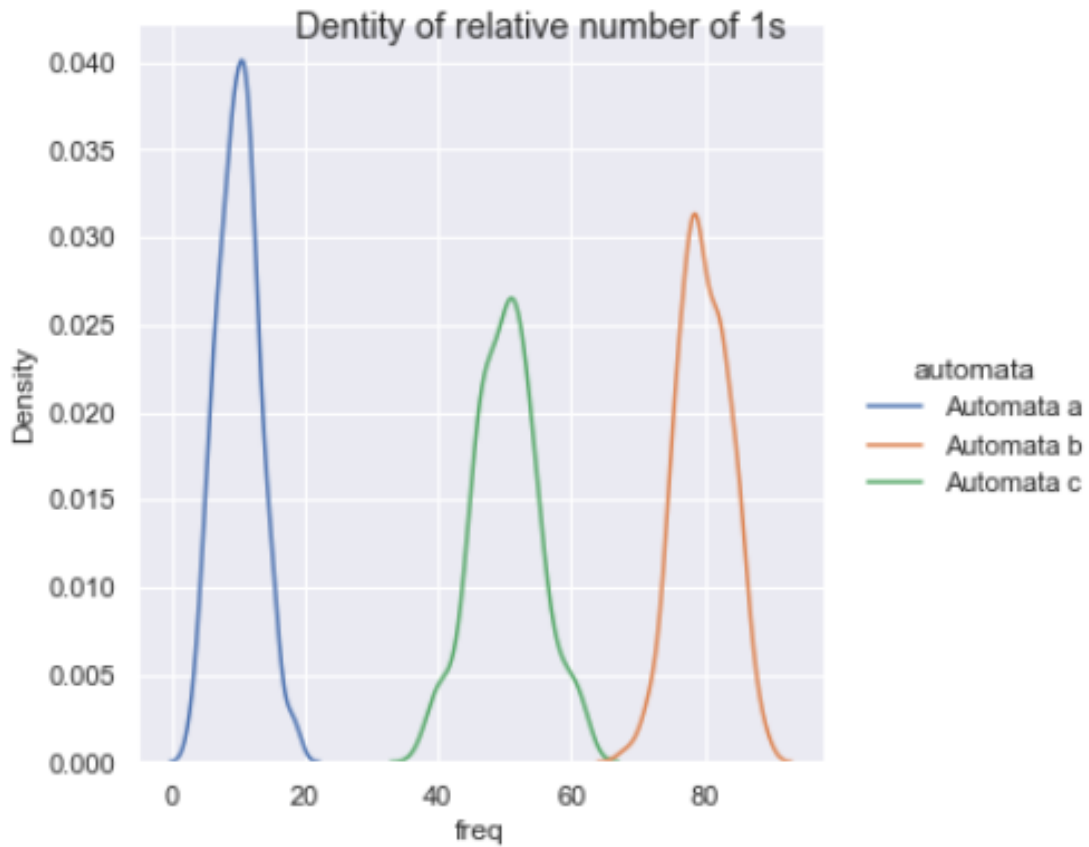
```
[7]:
```



Rensities of relative number of 1s obtained by binary probabilistic automata (a, b, c), as seen in CDT-22 figure 13.

```
[9]: display.Image("images/abc_patterns_distplot.png")
```

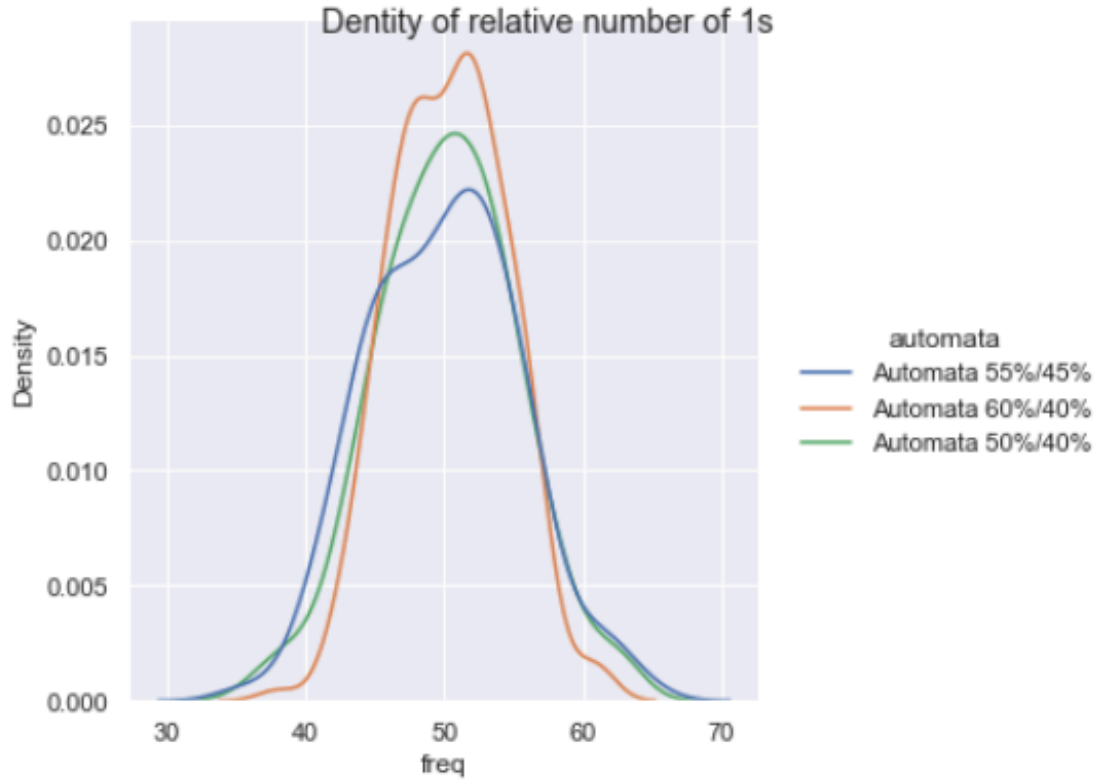
```
[9]:
```



Densities of relative number of 1s obtained by binary probabilistic automata with overlapping probabilities, as seen in CDT-22 figure 14.

```
[8]: display.Image("images/5050_patterns_distplot.png")
```

```
[8]:
```



0.3 Conclusions

The generation of patterns with probabilistic automata can be useful to produce dynamics in complex networks. It is important to be able to reproduce such patterns in order to generate synthetic diffusion phenomena.

0.4 References

- [1] L. da F. Costa. Where Do Patterns To Be Recognized Come From?. Researchgate, March 2020.