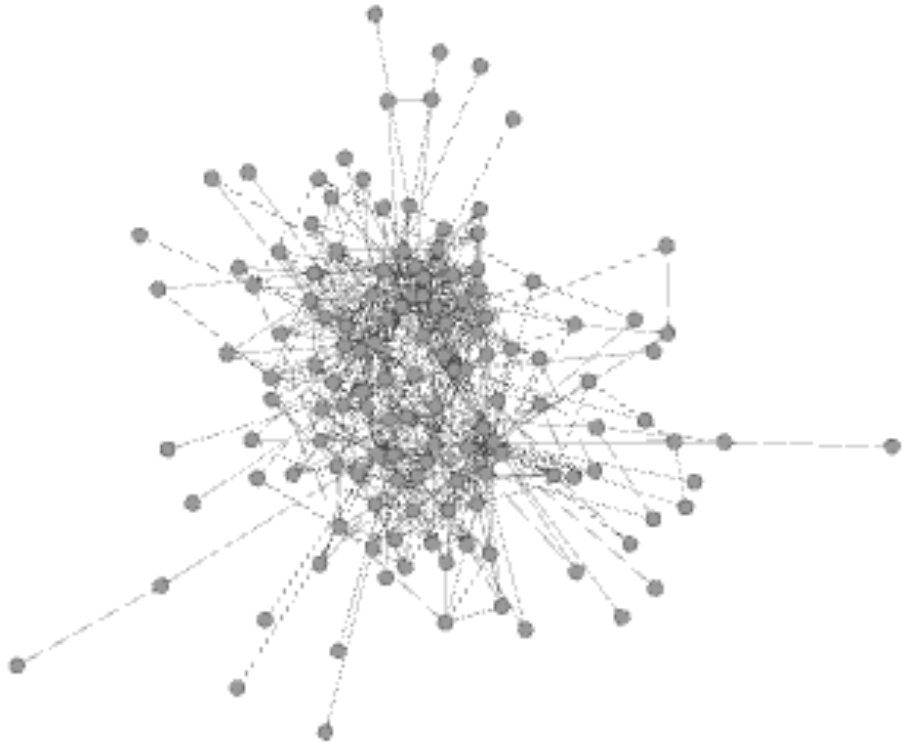
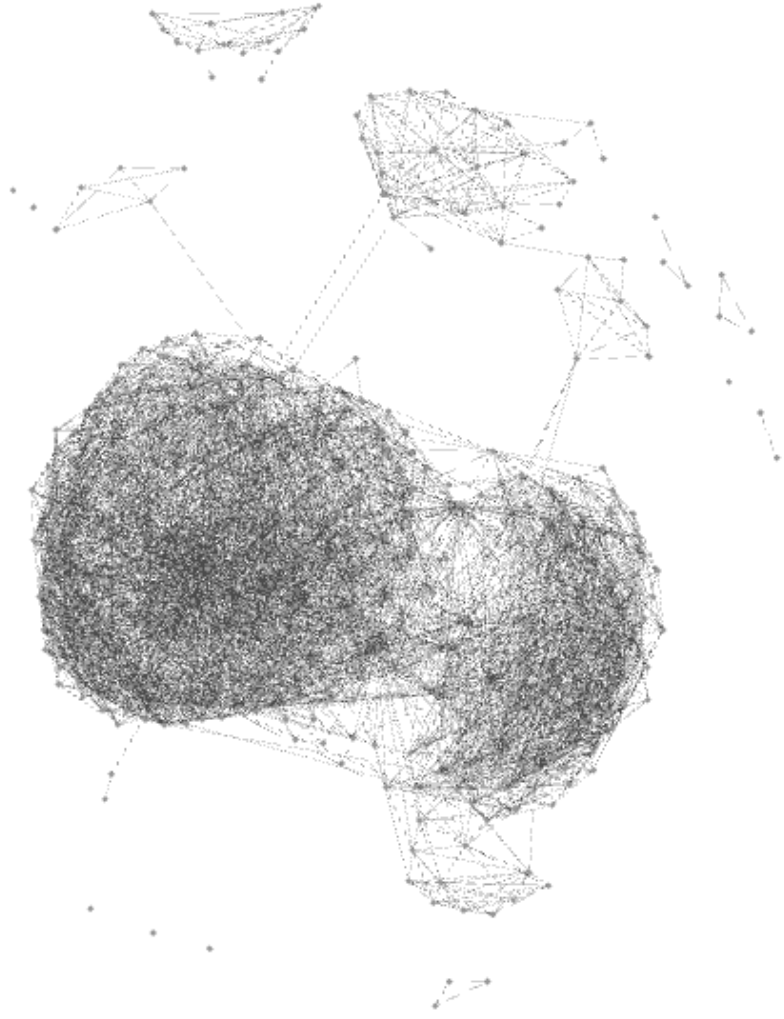
Stability of Certainty and Opinion on Influence Networks

Ariel Webster





Background

1. Networks Change

2. Opinion Change

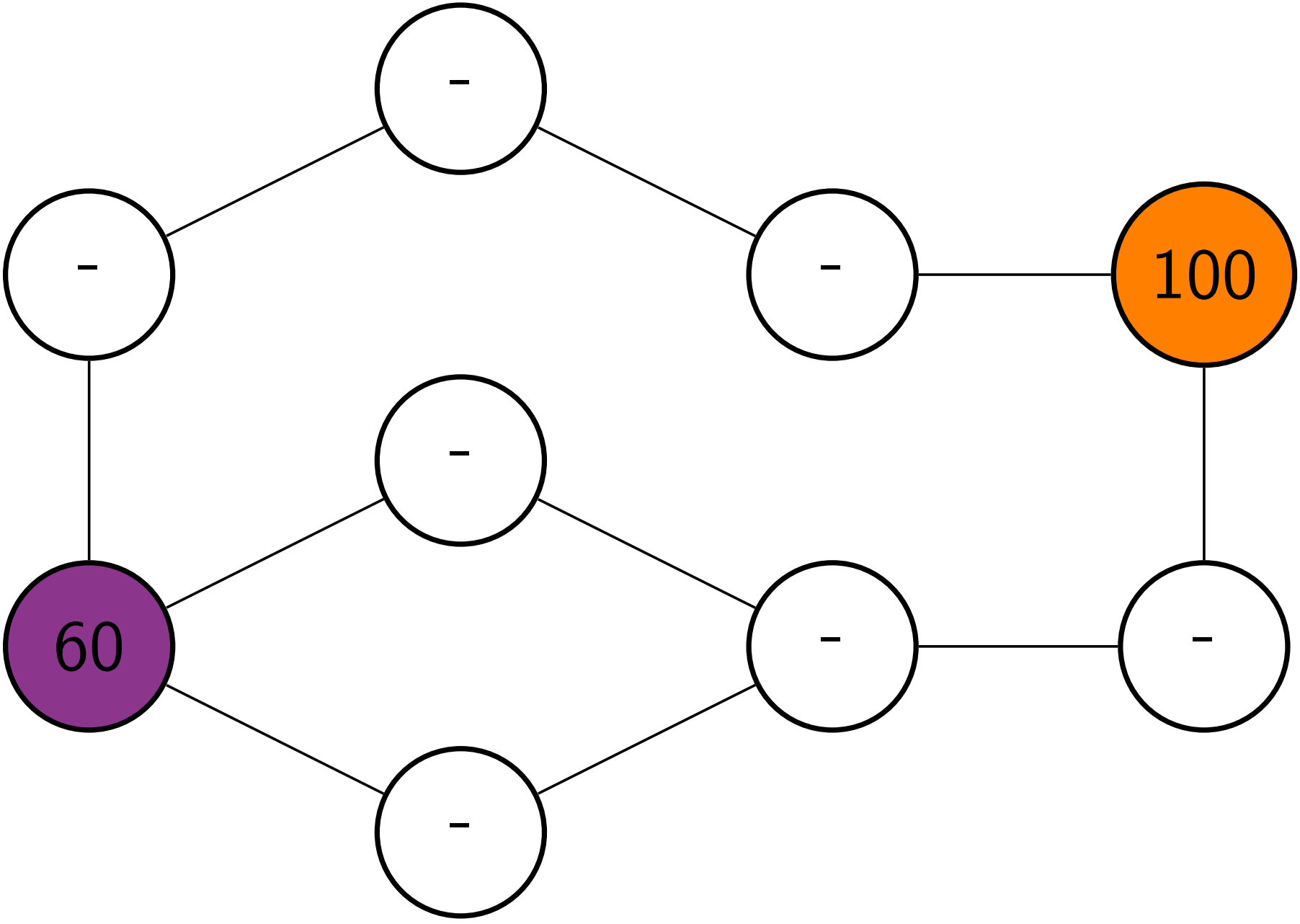
Opinion Change

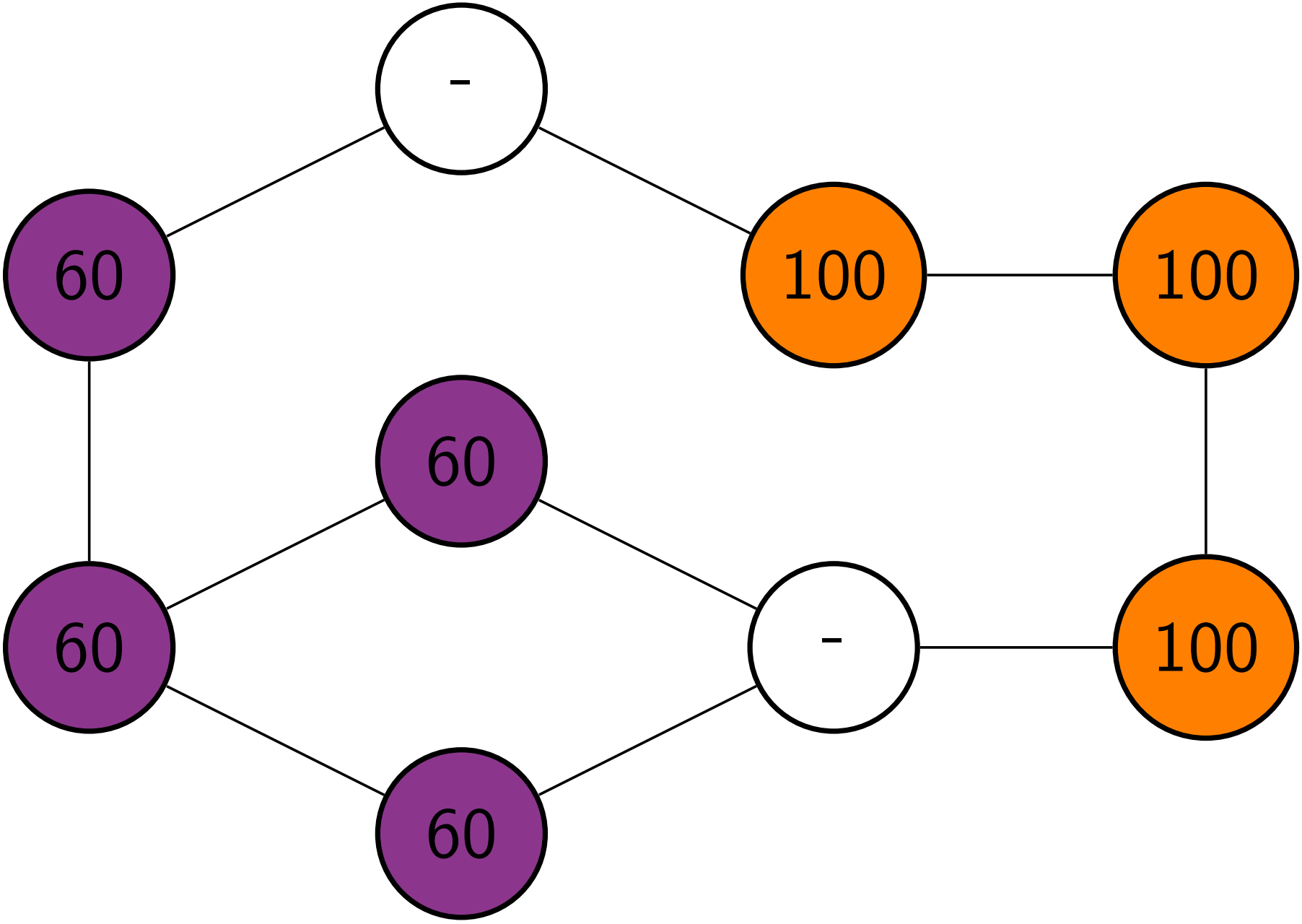
- Weight of Influence
- Degree of Change
    1. Conformity
    2. Compromise
    3. Stubbornness

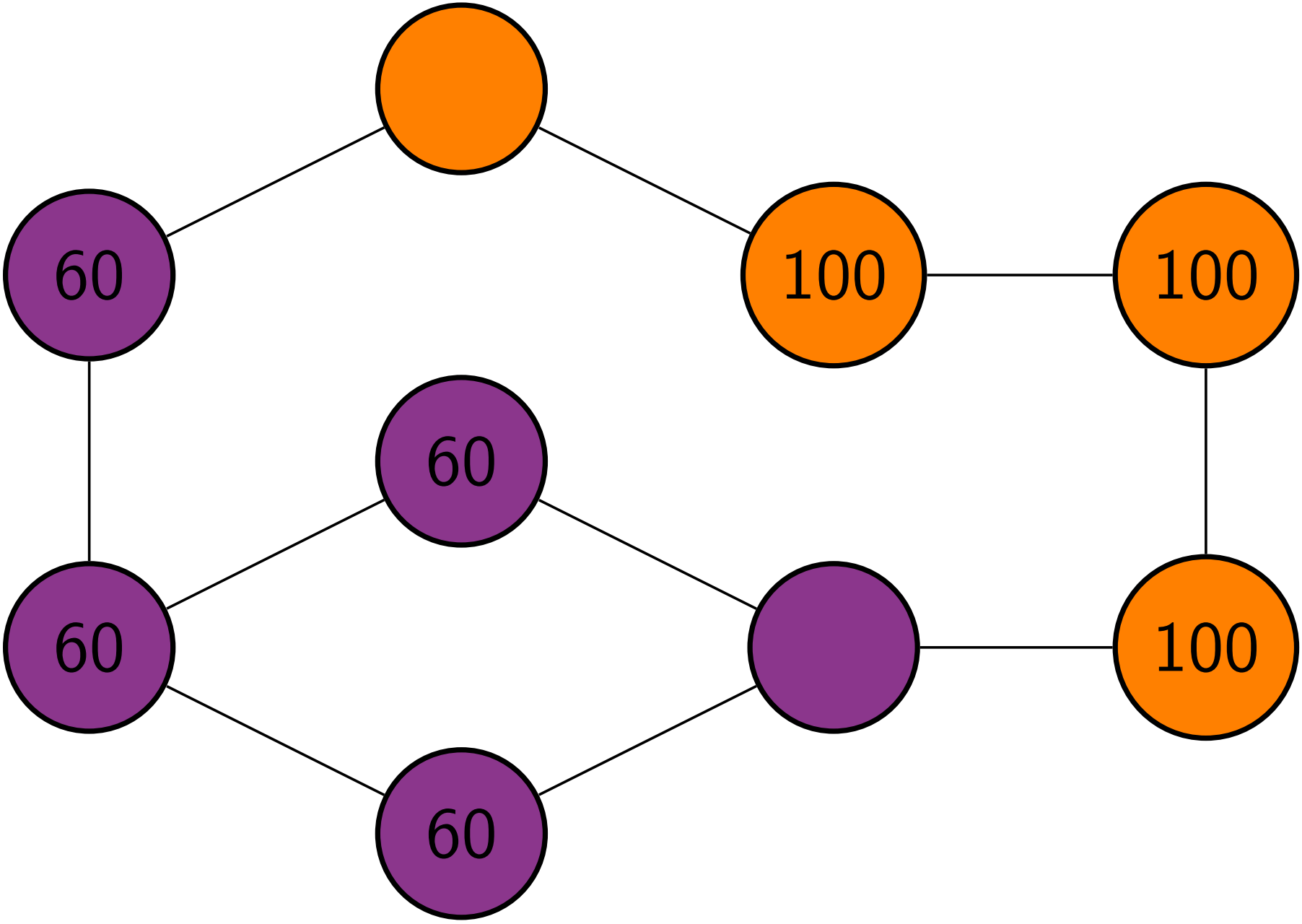
Initialization

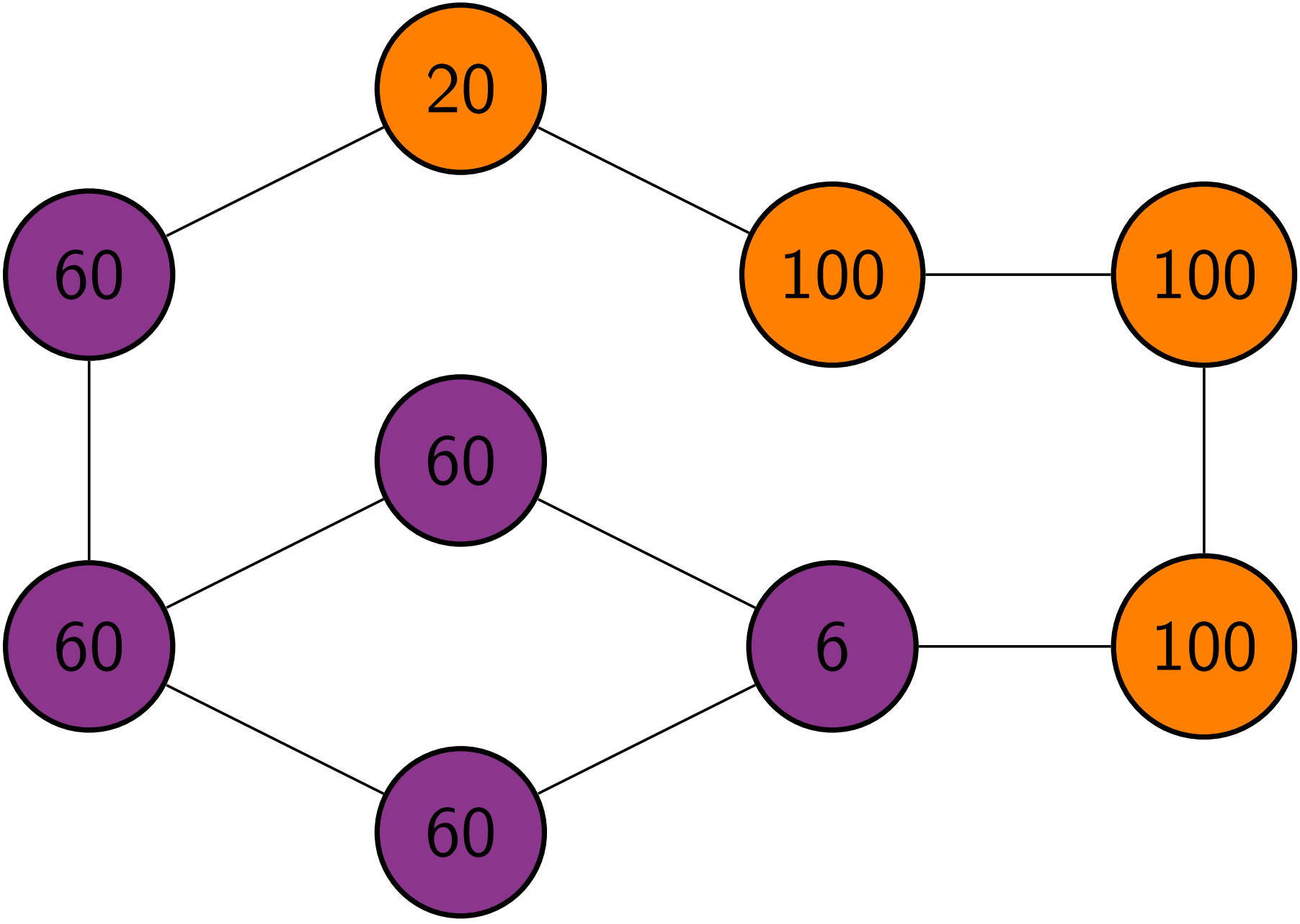
- Assignment
- Cascade

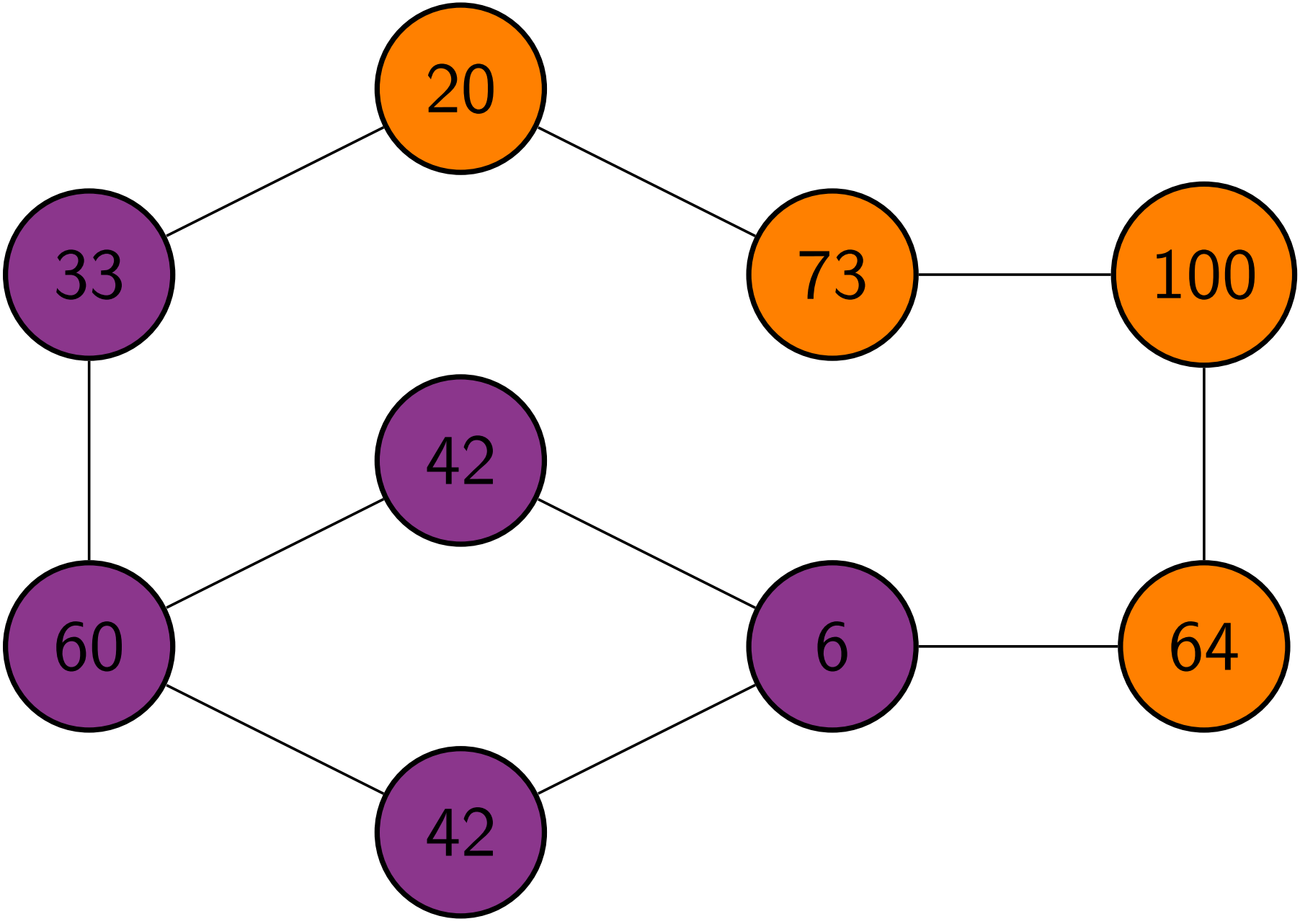
Certainty Model


-
-
-
100
-
60
-
-
-


-
60
100
100
60
60
-
100
60


60
100
100
60
60
100
60


20
60
100
100
60
60
6
100
60

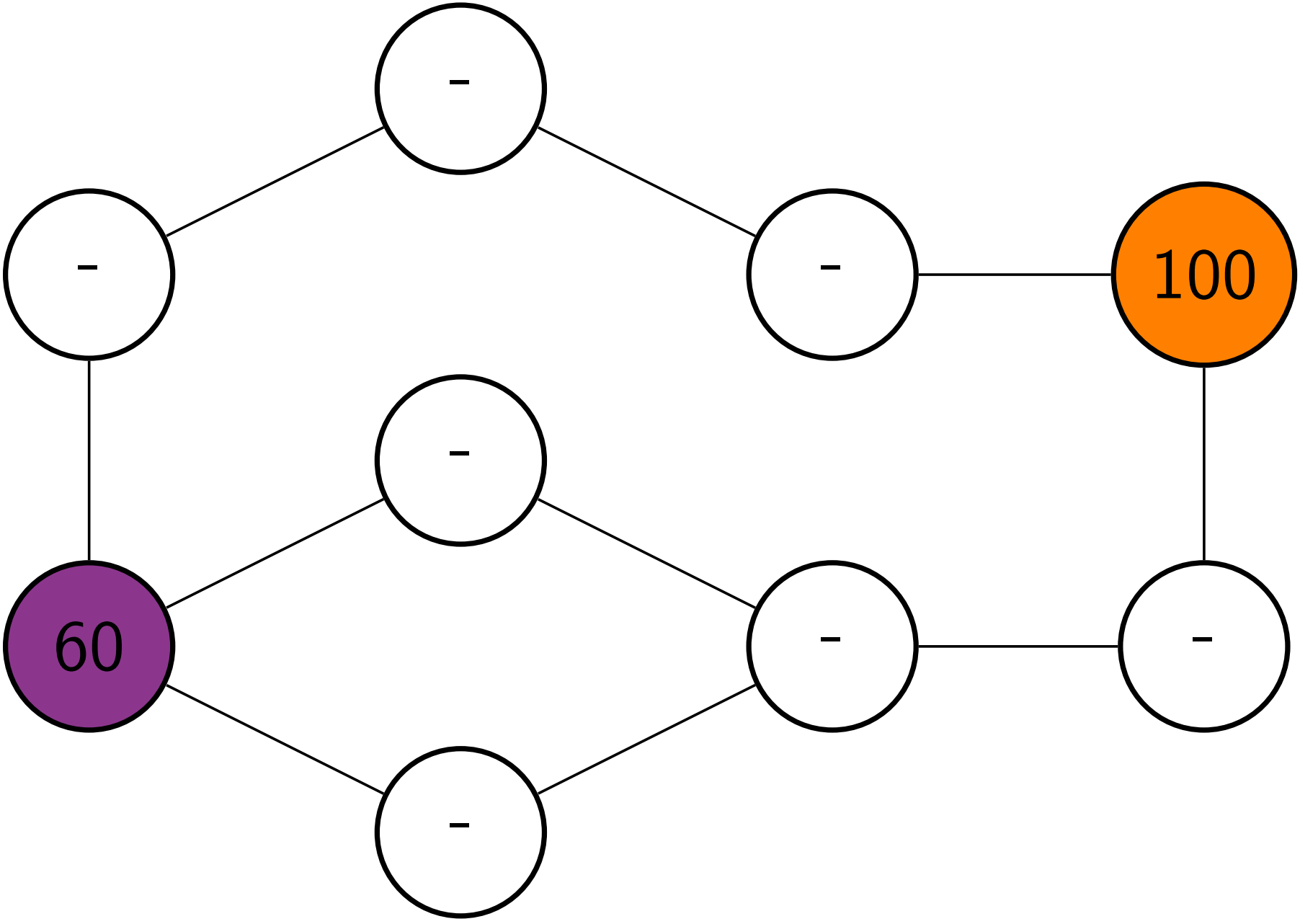

20
33
73
100
42
60
6
64
42

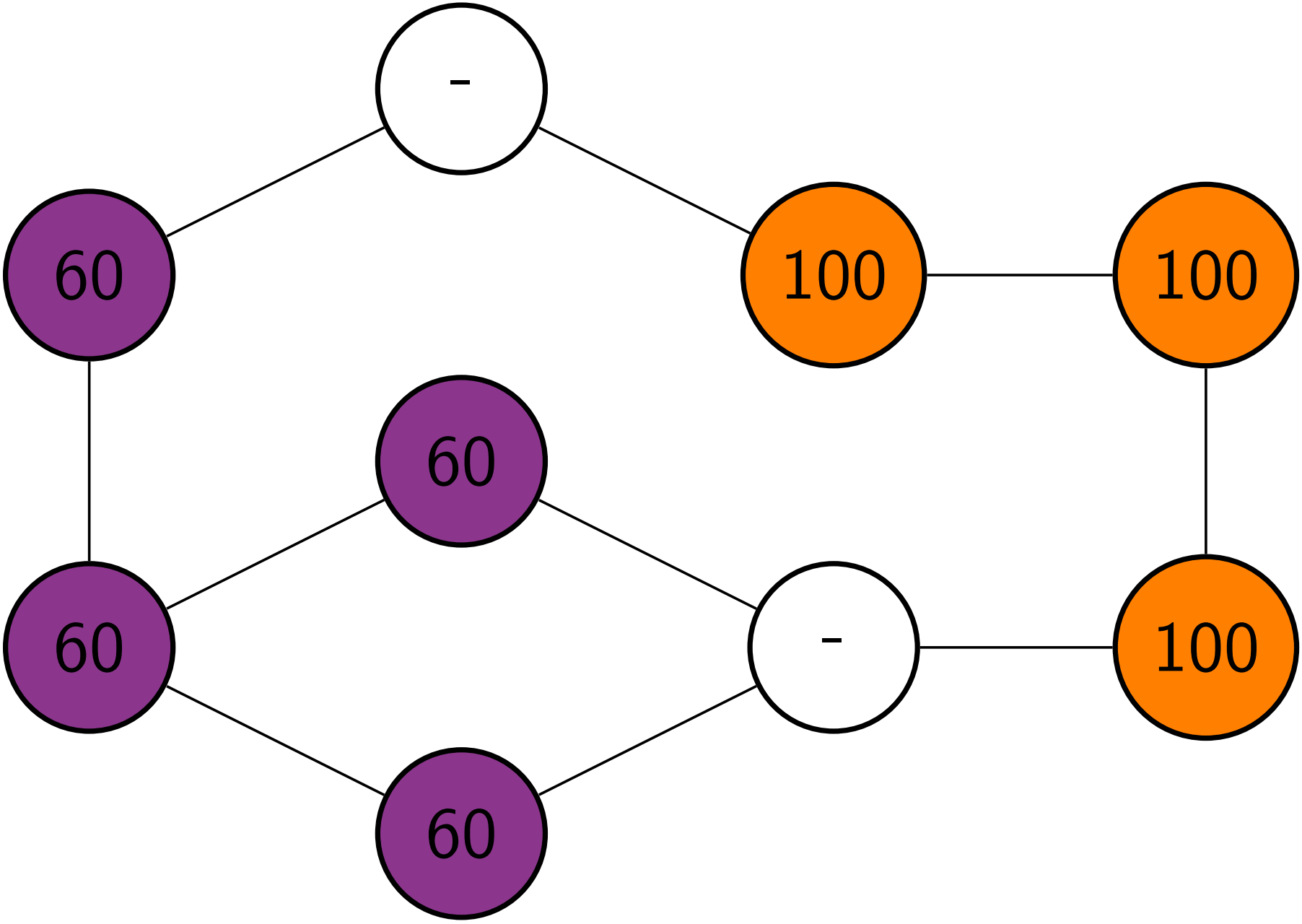
Stability

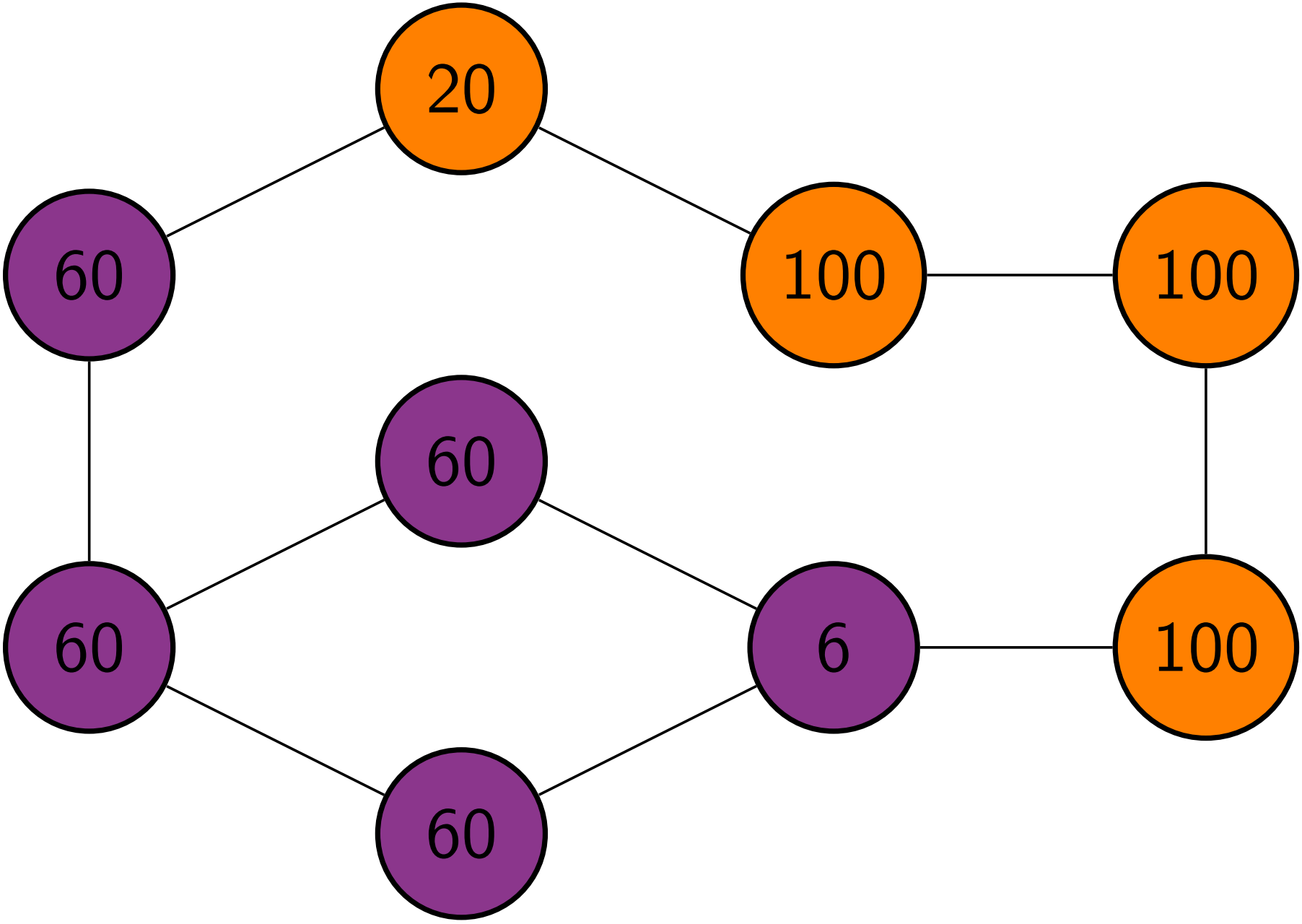
- Number
- Opinion
- Certainty

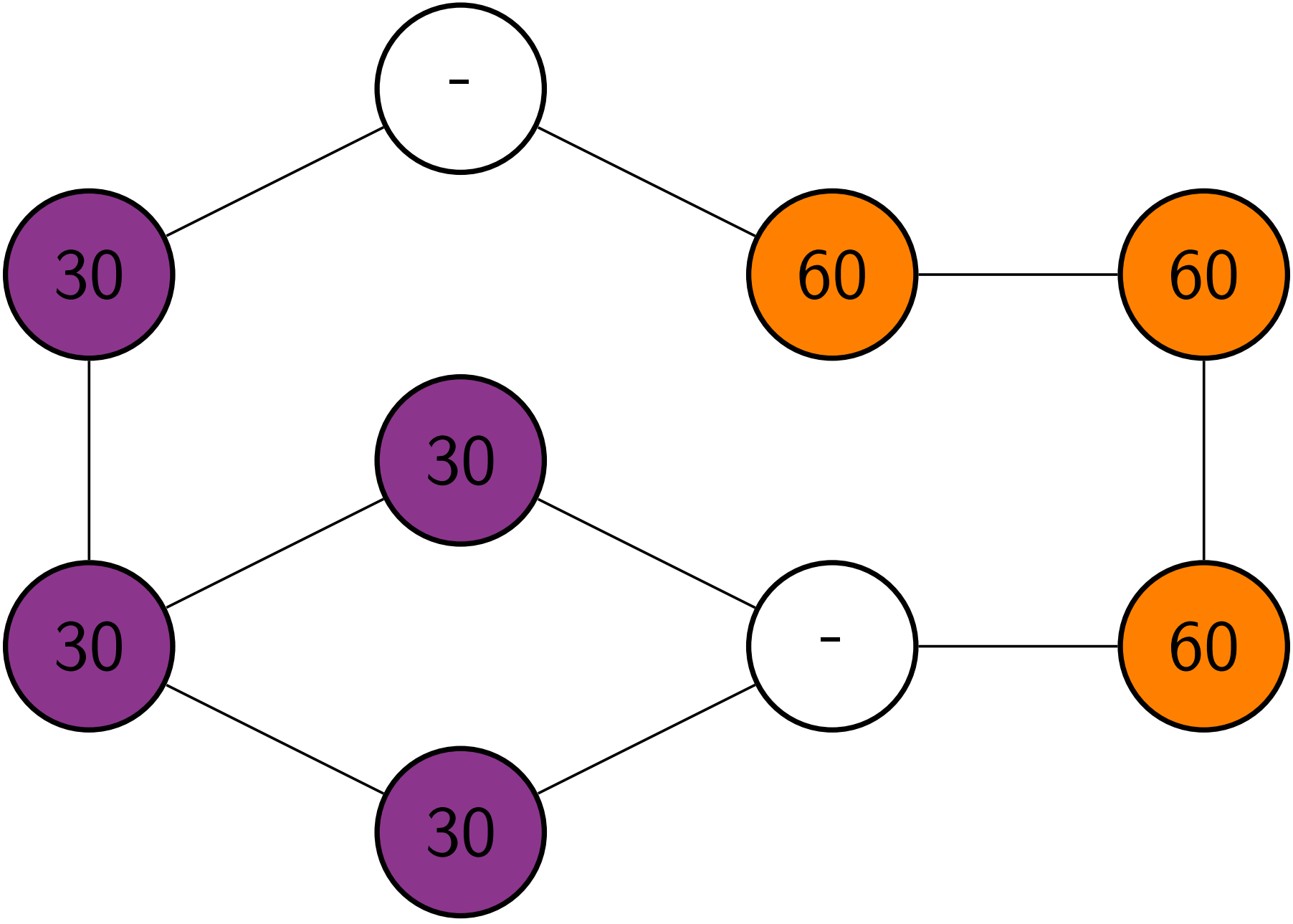
Stability of Number

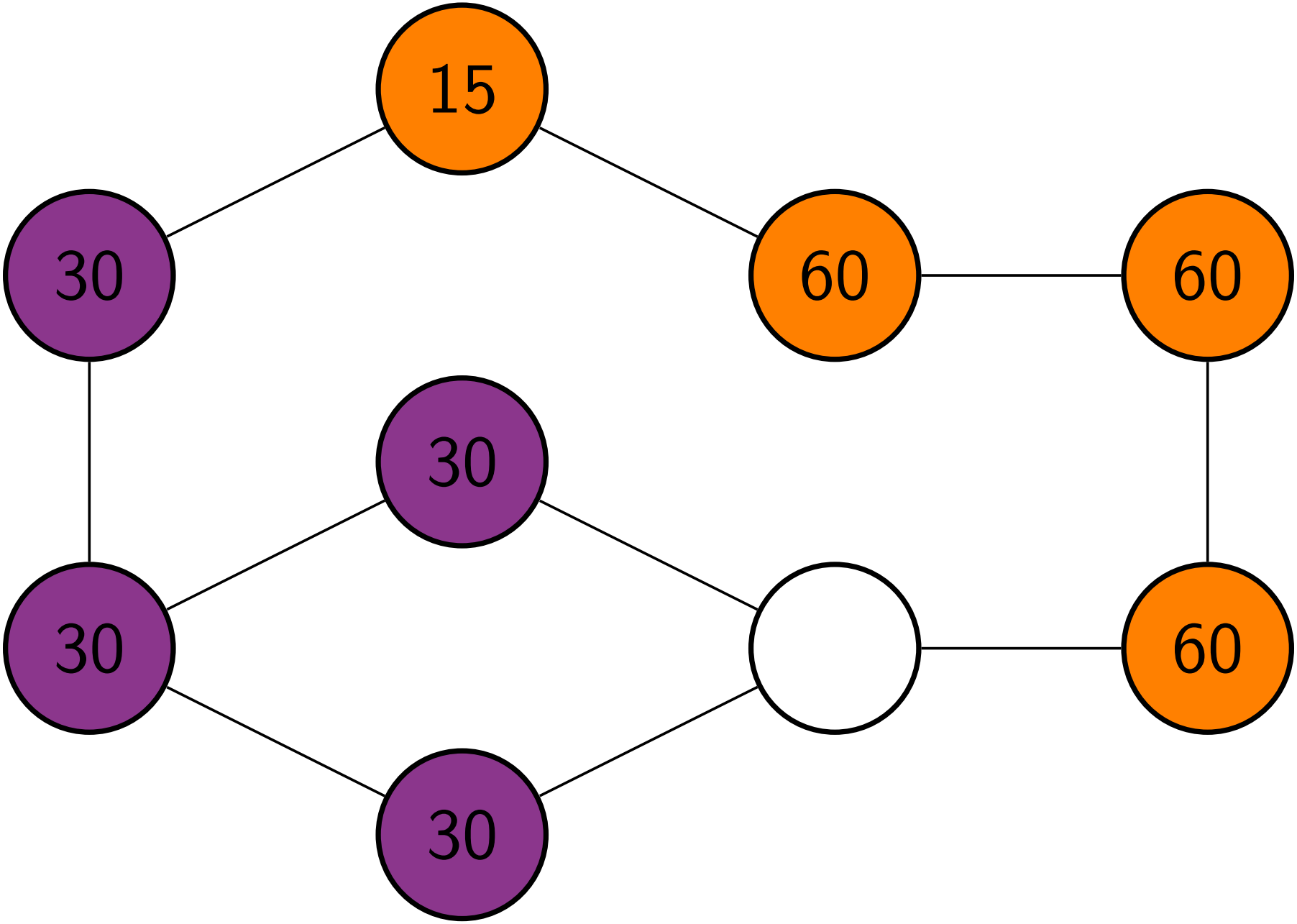
O(n)

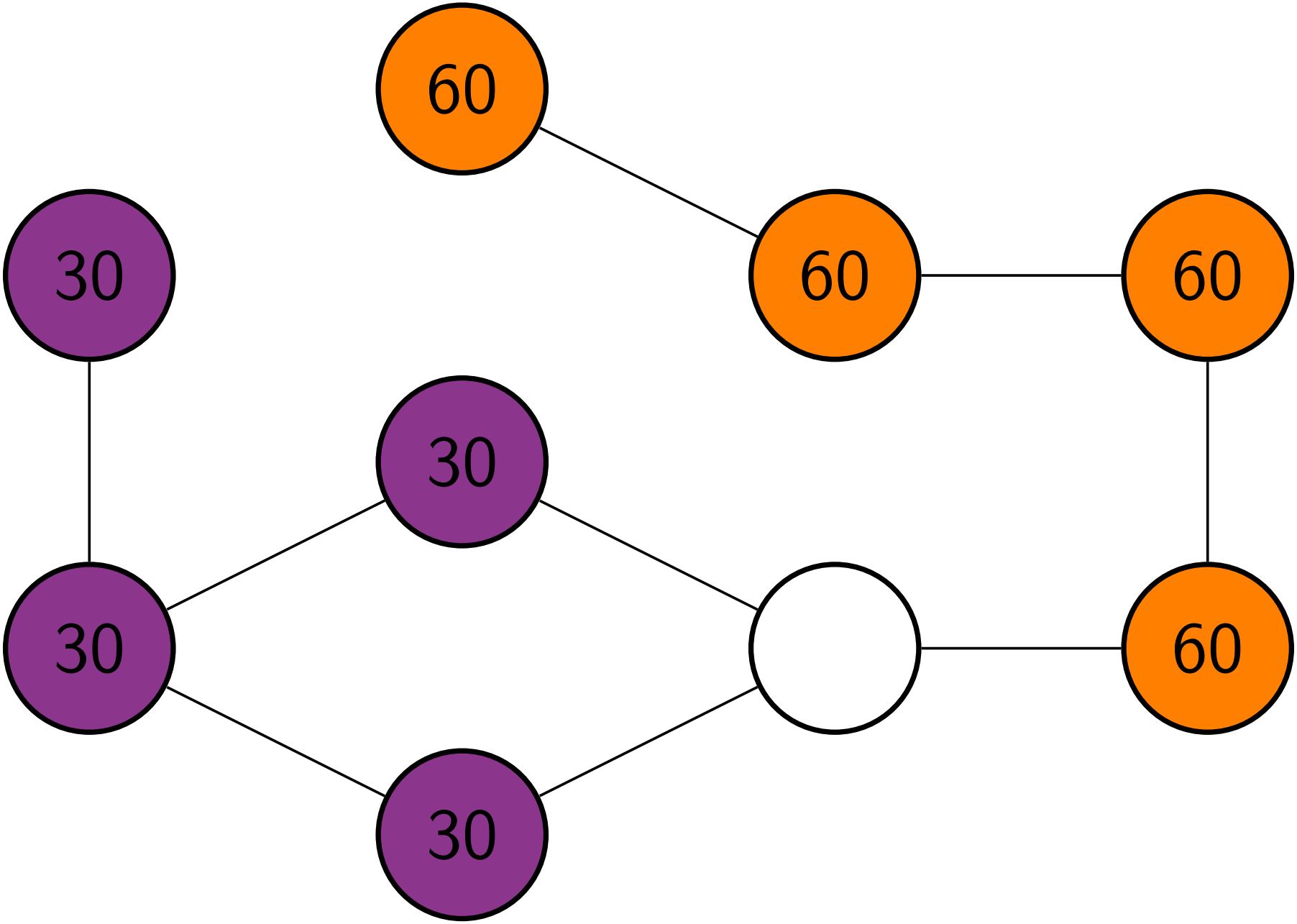

-
-
-
100
-
60
-
-
-

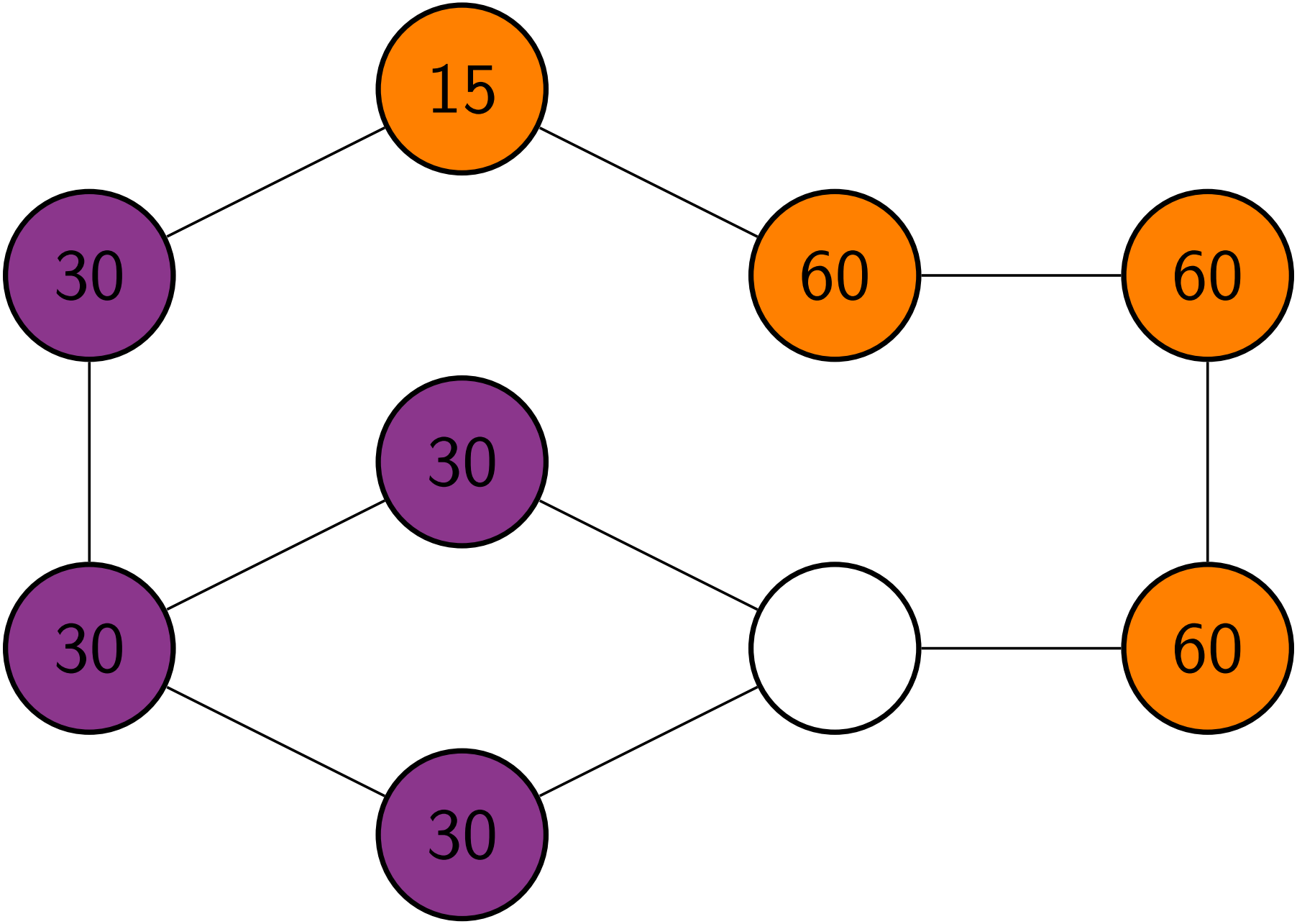

-
60
100
100
60
60
-
100
60

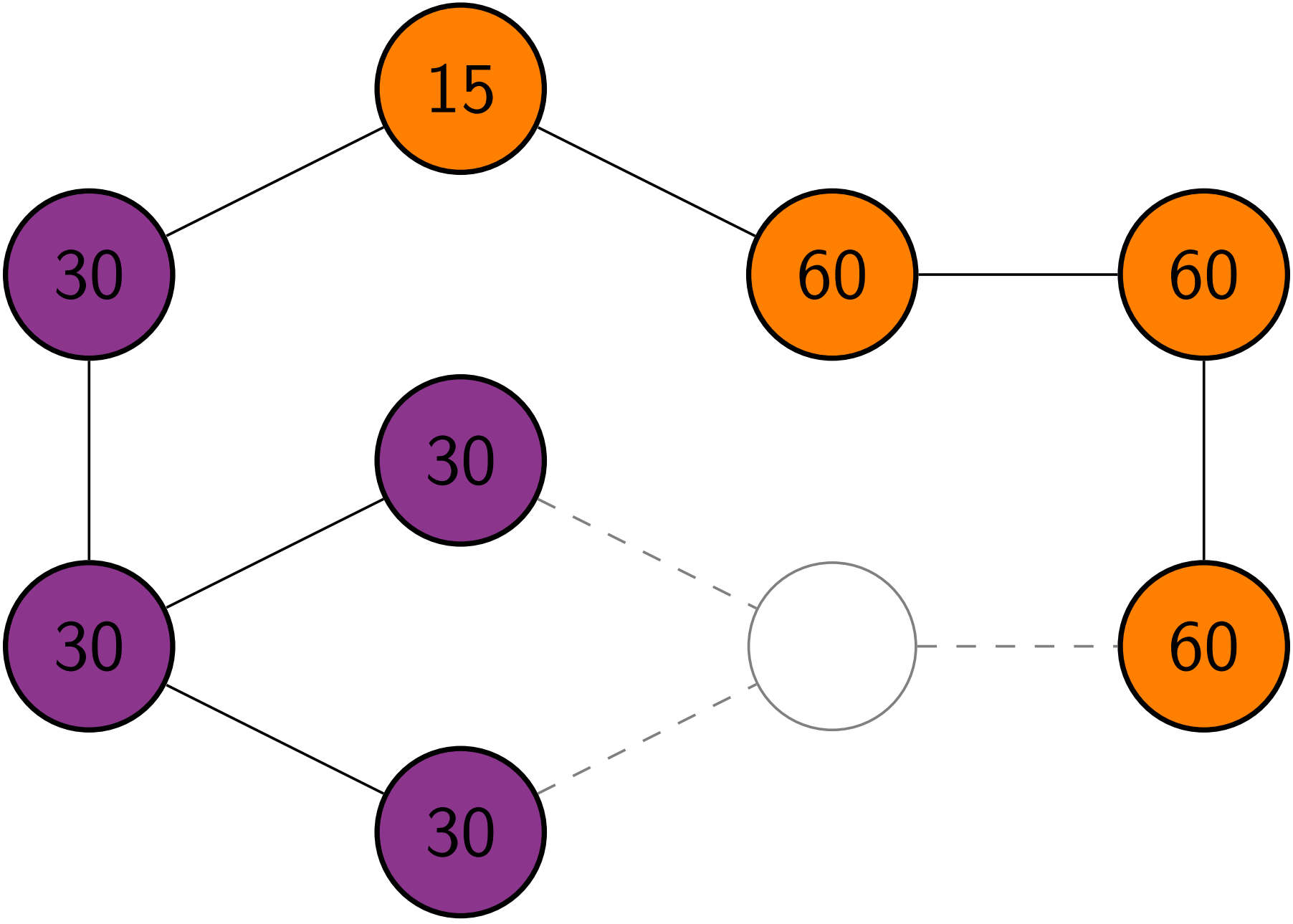

20
60
100
100
60
60
6
100
60

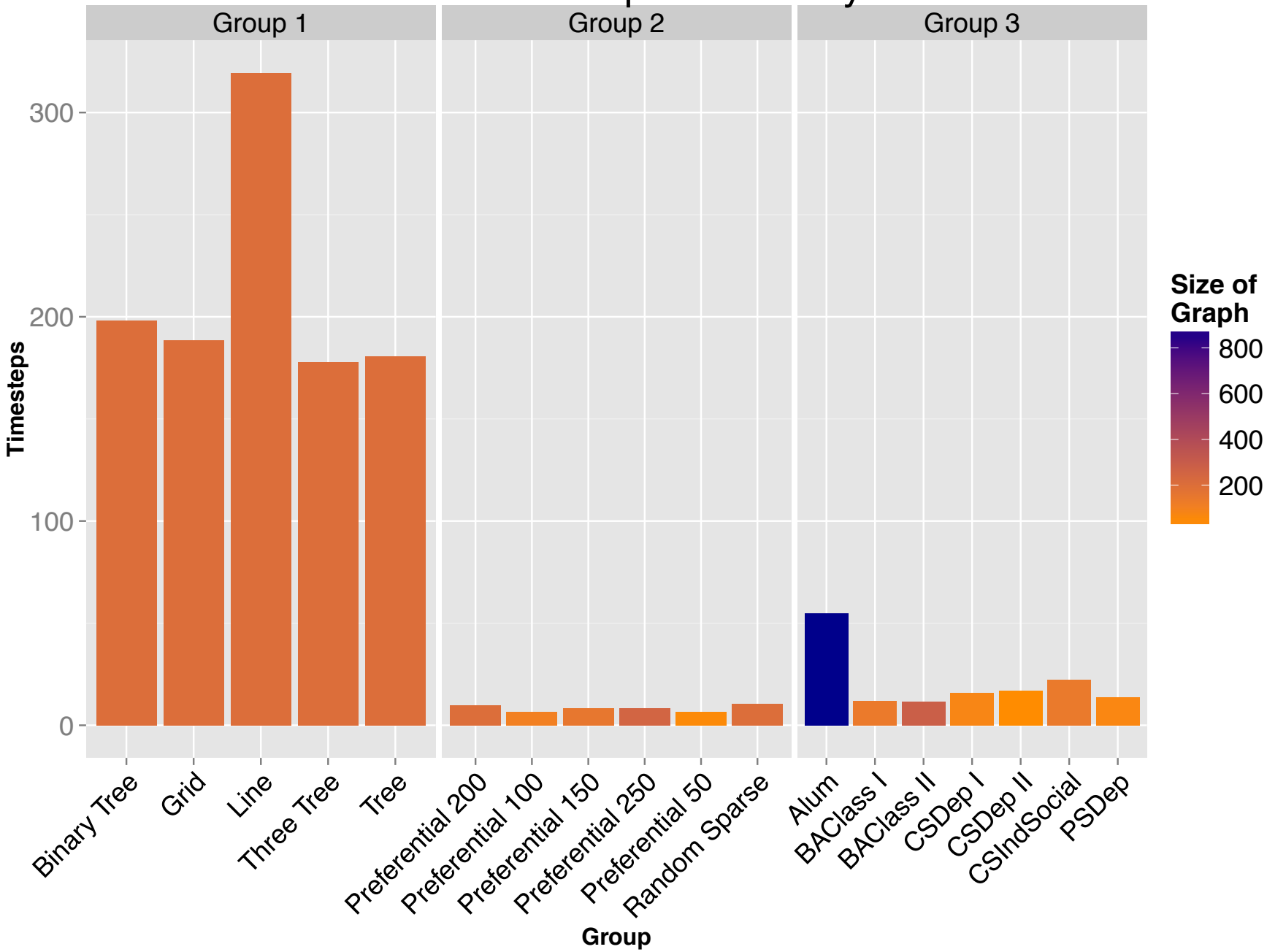

-
30
60
60
30
30
-
60
30


15
30
60
60
30
30
60
30

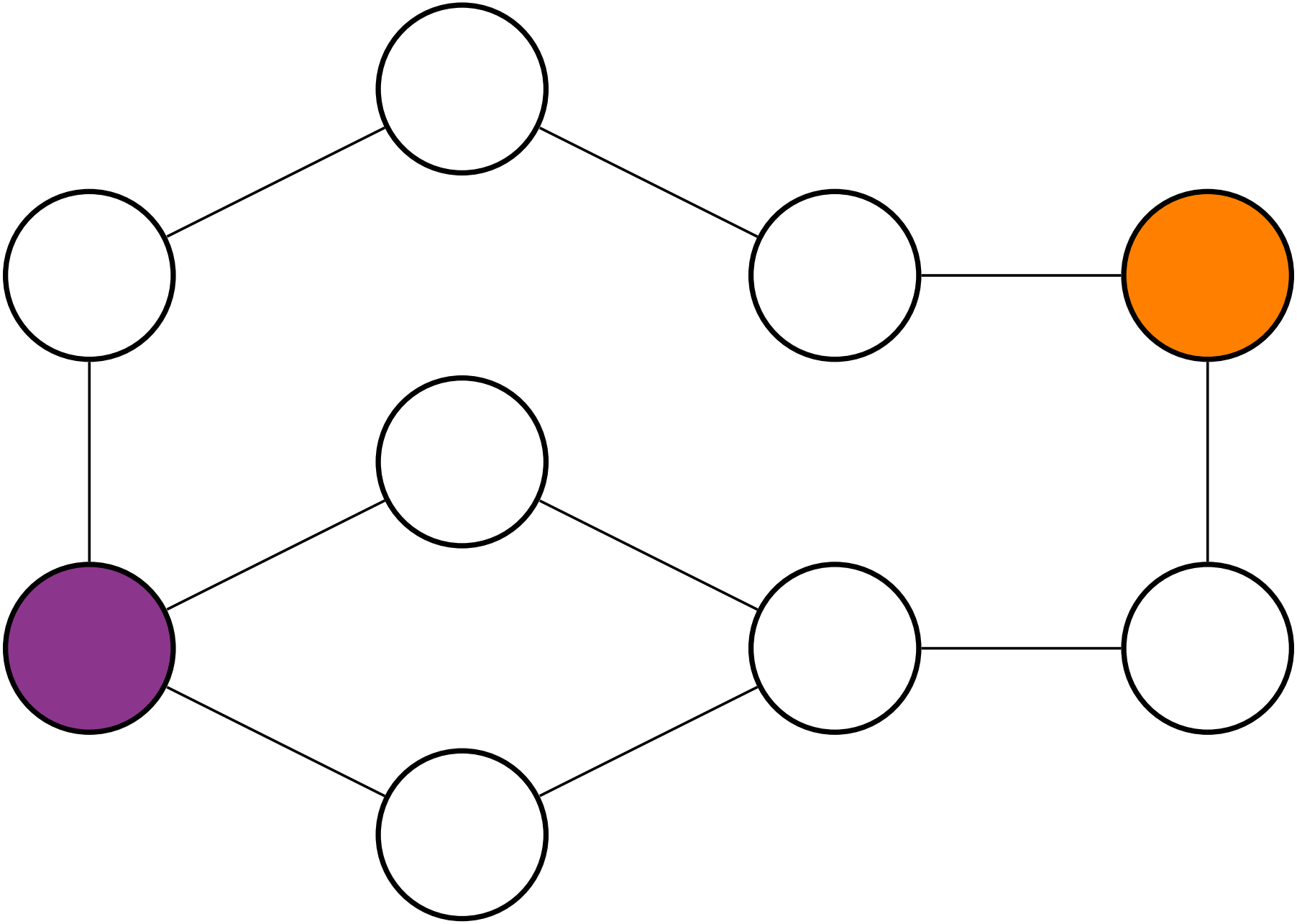

60
30
60
60
30
30
60
30

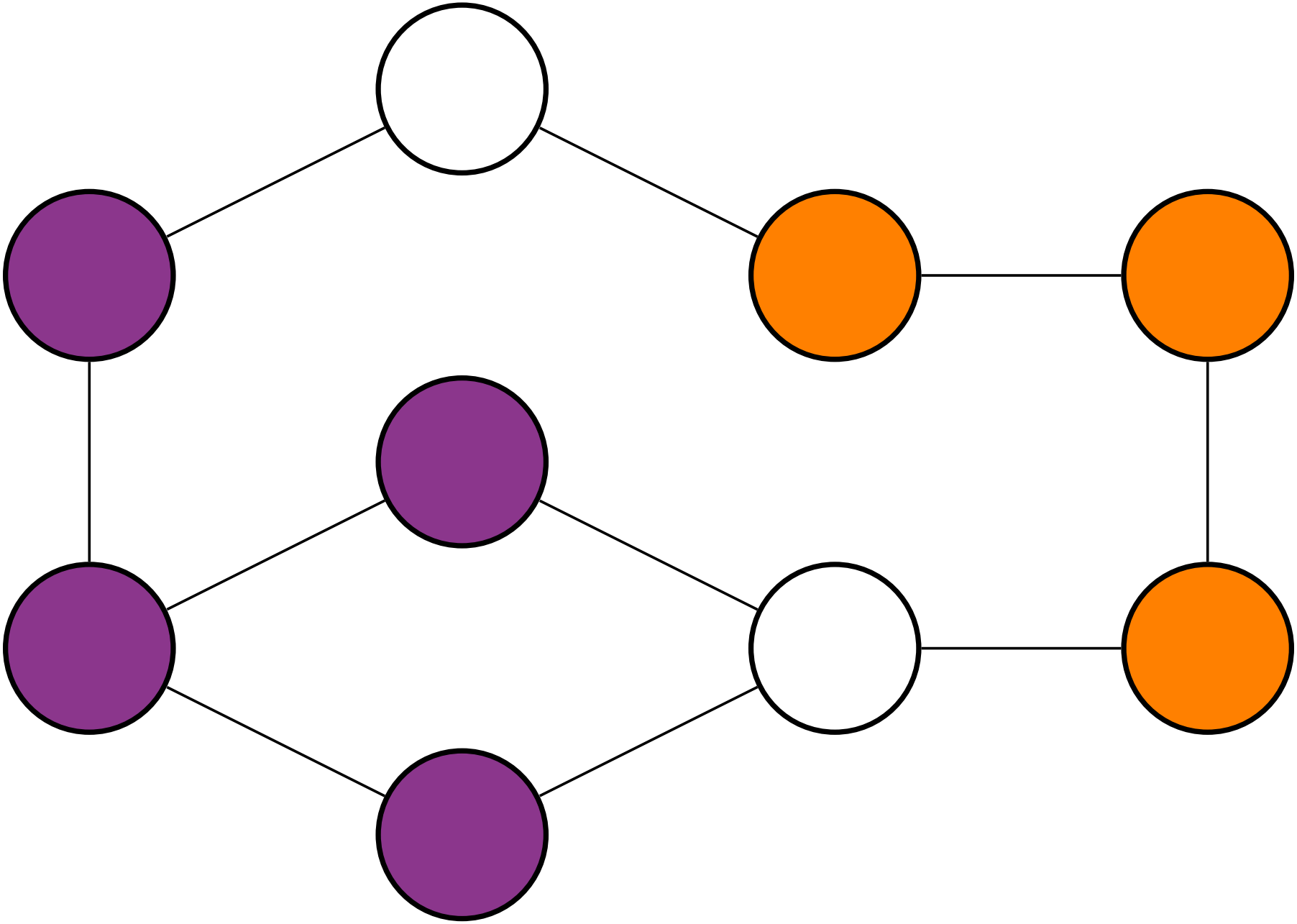

15
30
60
60
30
30
60
30

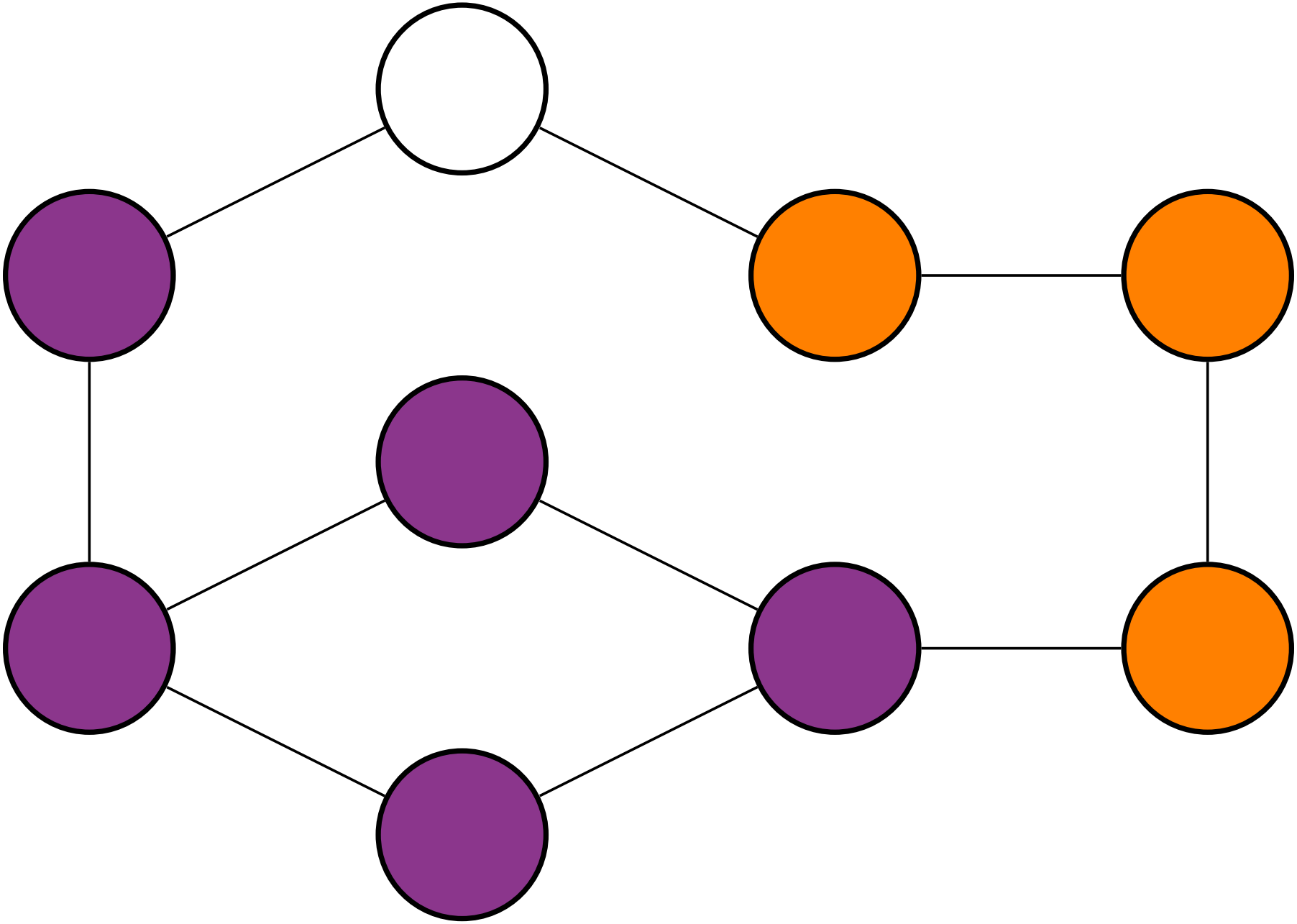

15
30
60
60
30
30
60
30


Mean Timesteps to Stability
Group 1
Group 2
Group 3
300
200
100
0
Timesteps
Size of Graph
800
600
400
200
Binary Tree
Grid
Line
Three Tree
Tree
Preferential 200
Preferential 100
Preferential 150
Preferential 250
Preferential 50
Random Sparse
Alum
BAClass I
BAClass II
CSDep I
CSDep II
CSIndSocial
PSDep
Group

Pure Opinion Model







Stability

- Number
- Opinion
- Certainty

Stability

- Number
- Opinion
- ~~Certainty~~

Period Stability

Majority Rules Model

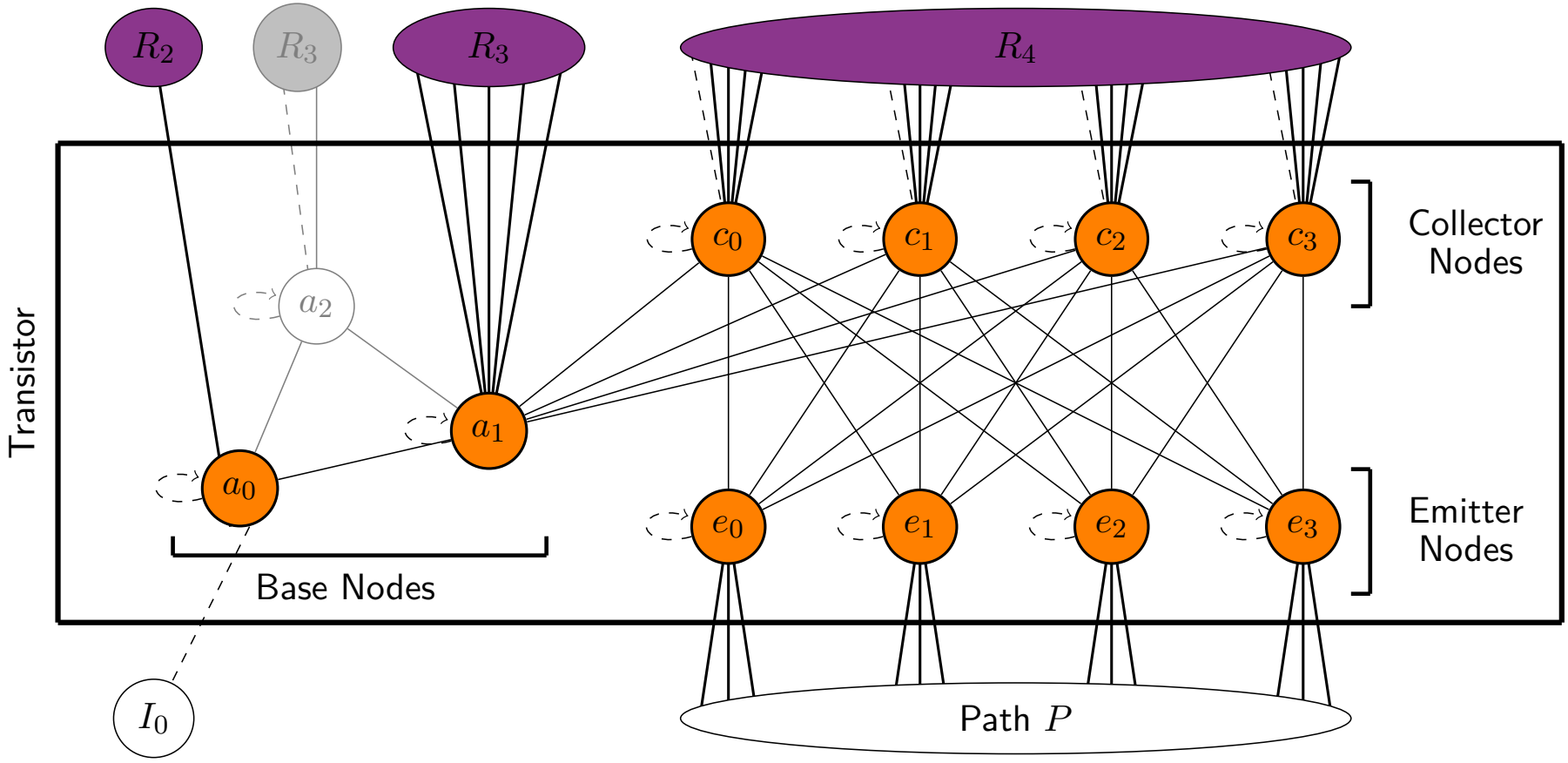
Frischknecht, Keller, and Wattenhofer Model

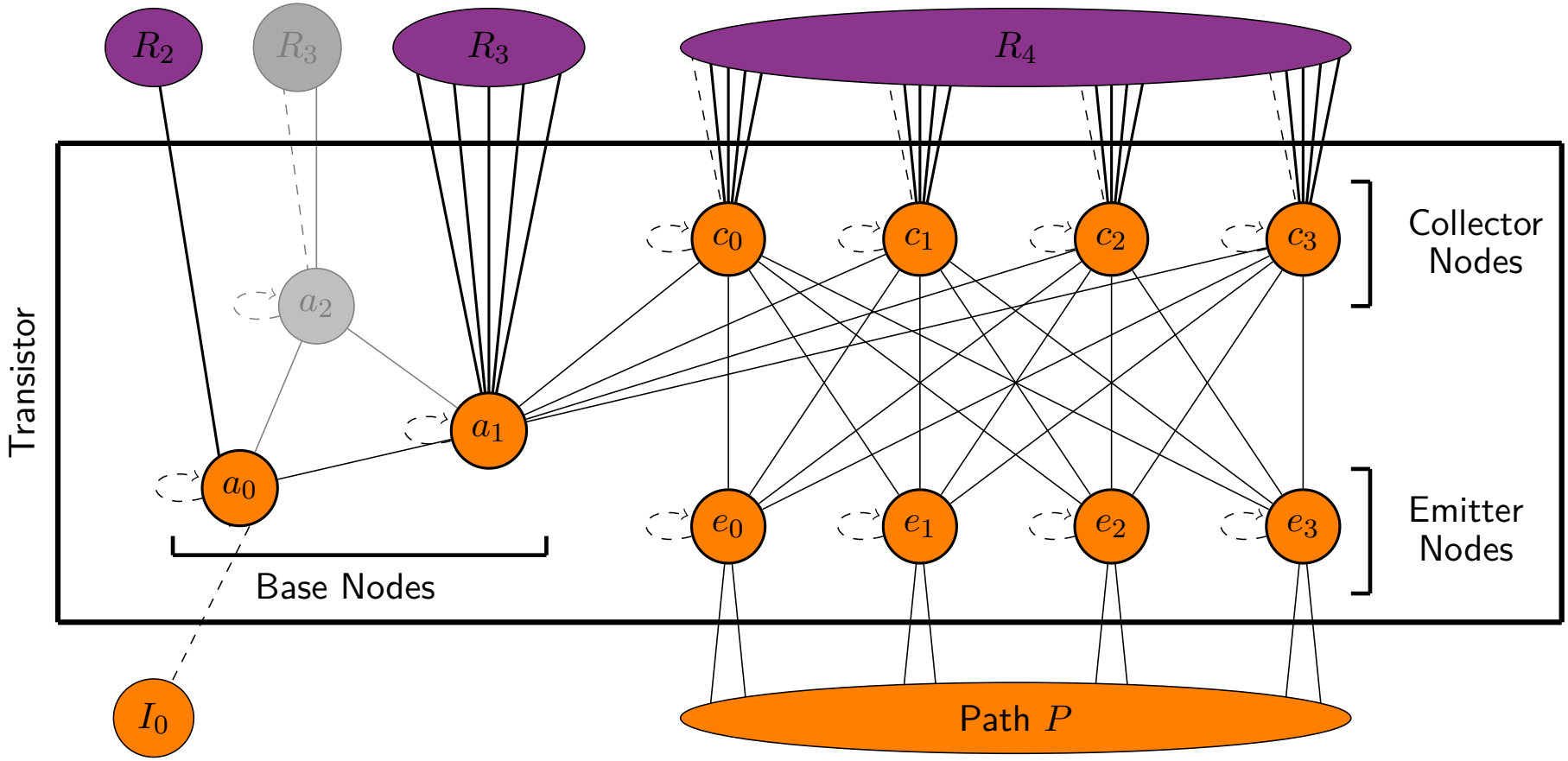
A Transistor

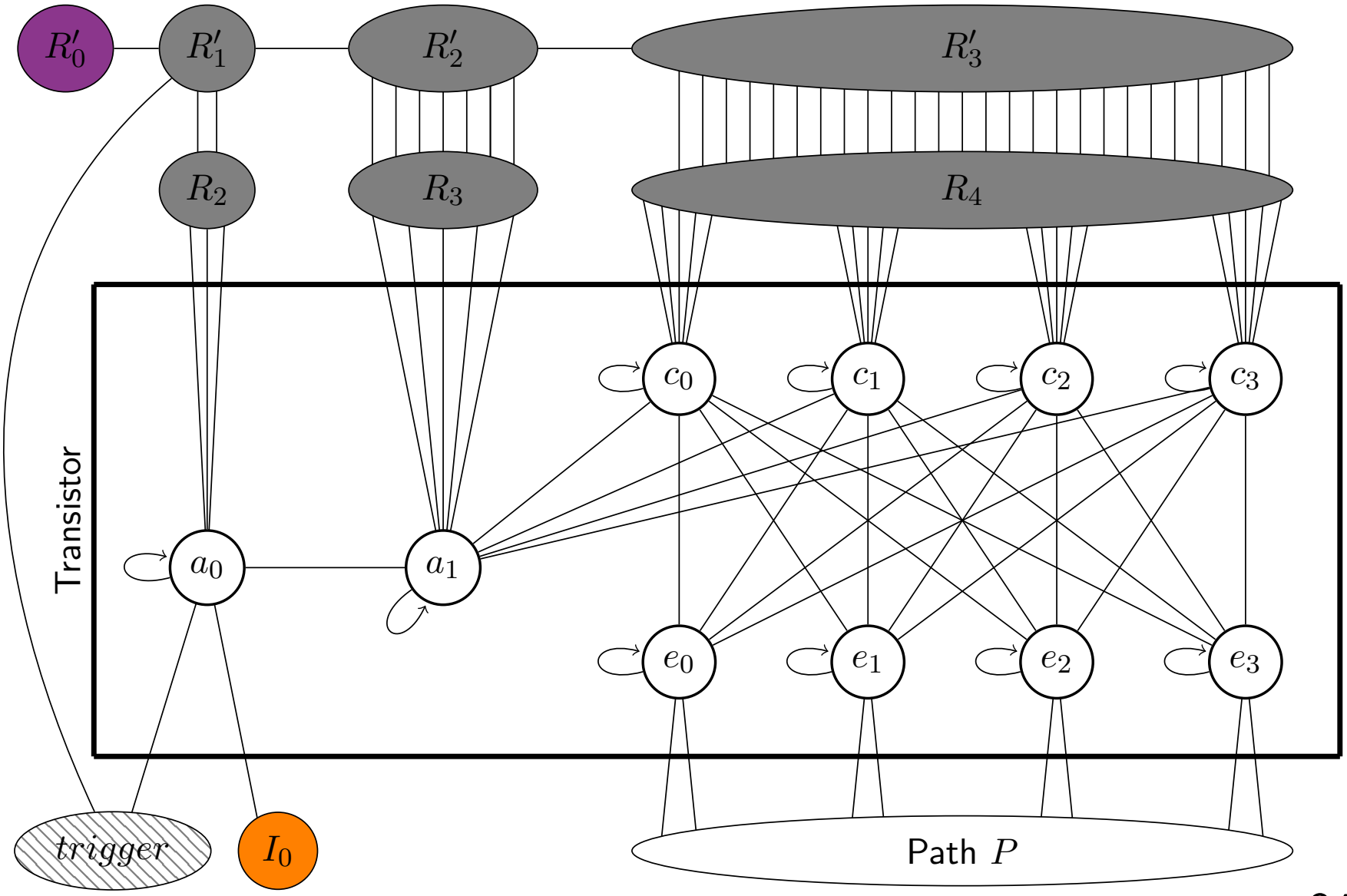
A transistor of size k can change $O(k^2)$ nodes in $O(k^2)$ timesteps.

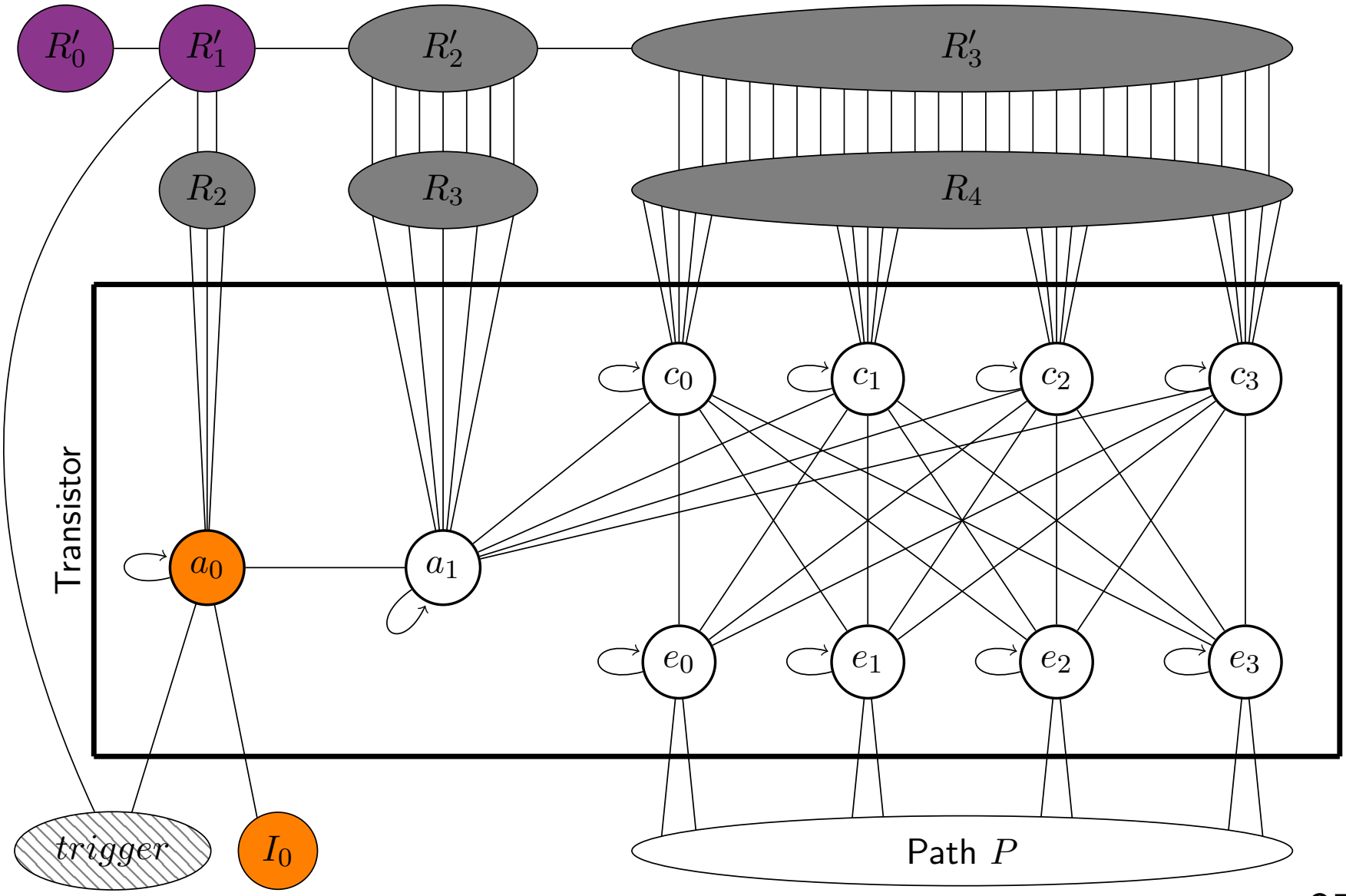
When there are k transistors the graph will stabilize in $\Omega(n^{\frac{3}{2}})$ timesteps.

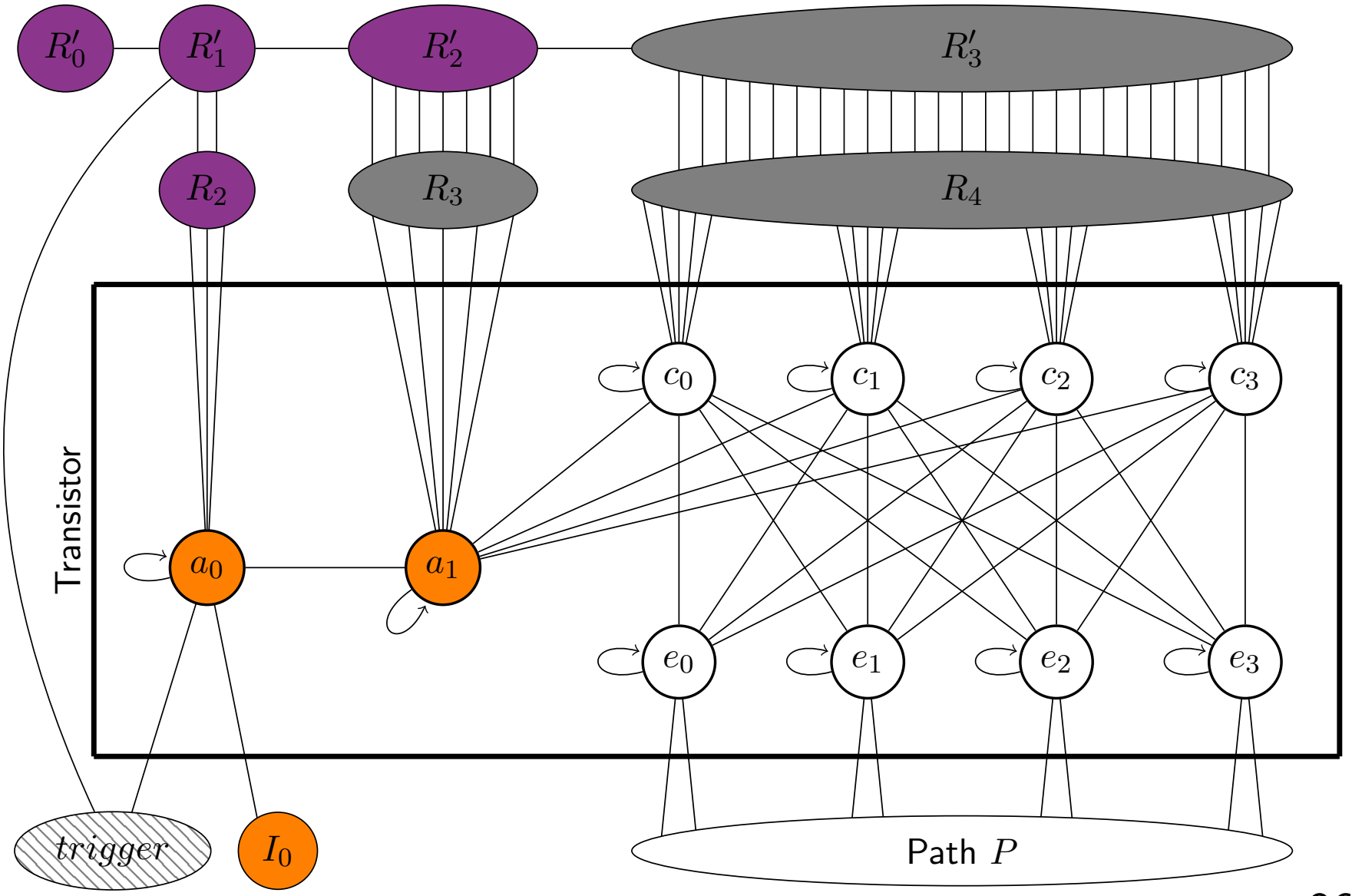
Transistor

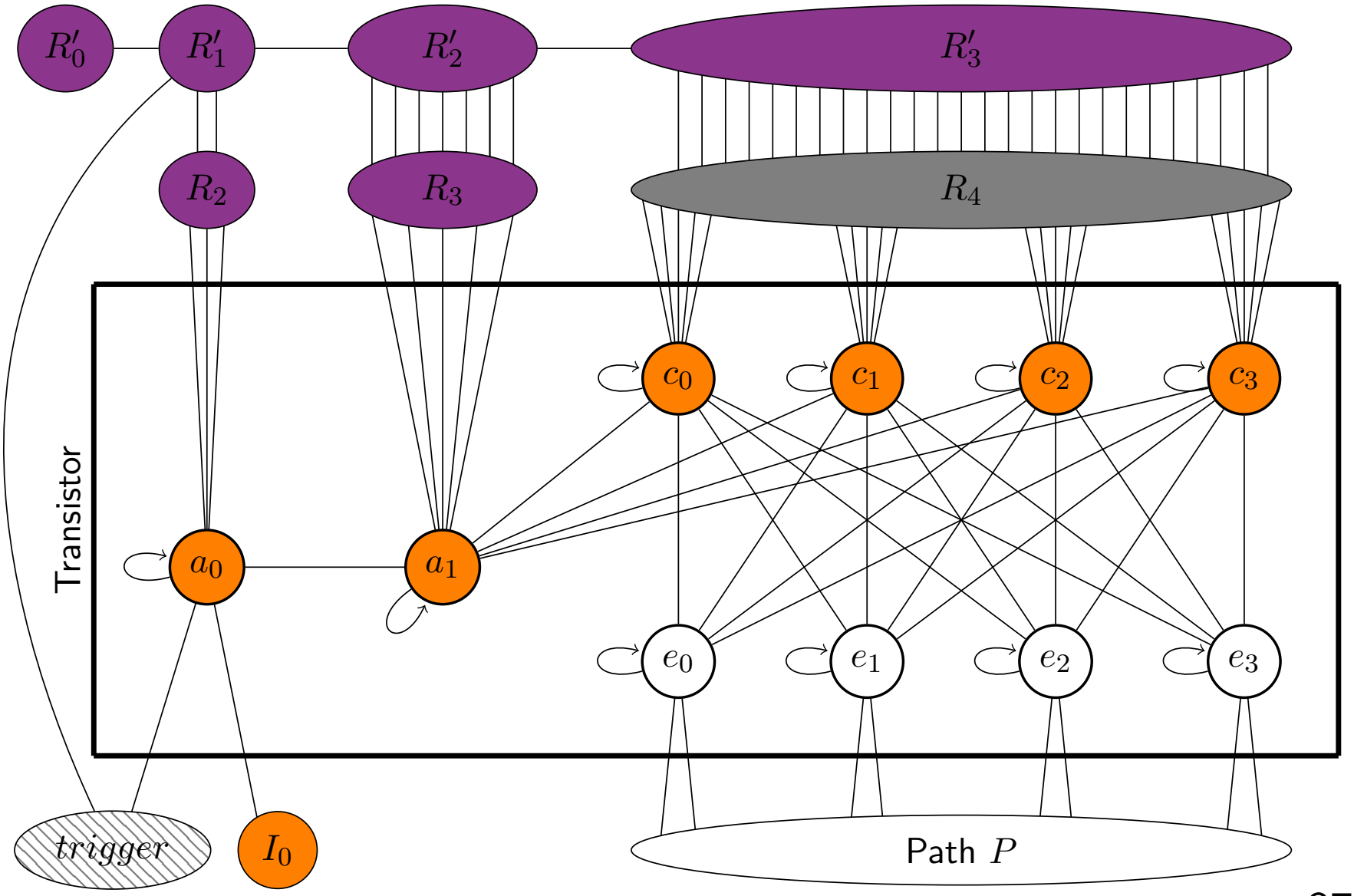

R_2
R_3
R_3
R_4
c_0
c_1
c_2
c_3
Collector Nodes
a_2
a_1
a_0
Transistor
e_0
e_1
e_2
e_3
Emitter Nodes
Base Nodes
I_0
Path P

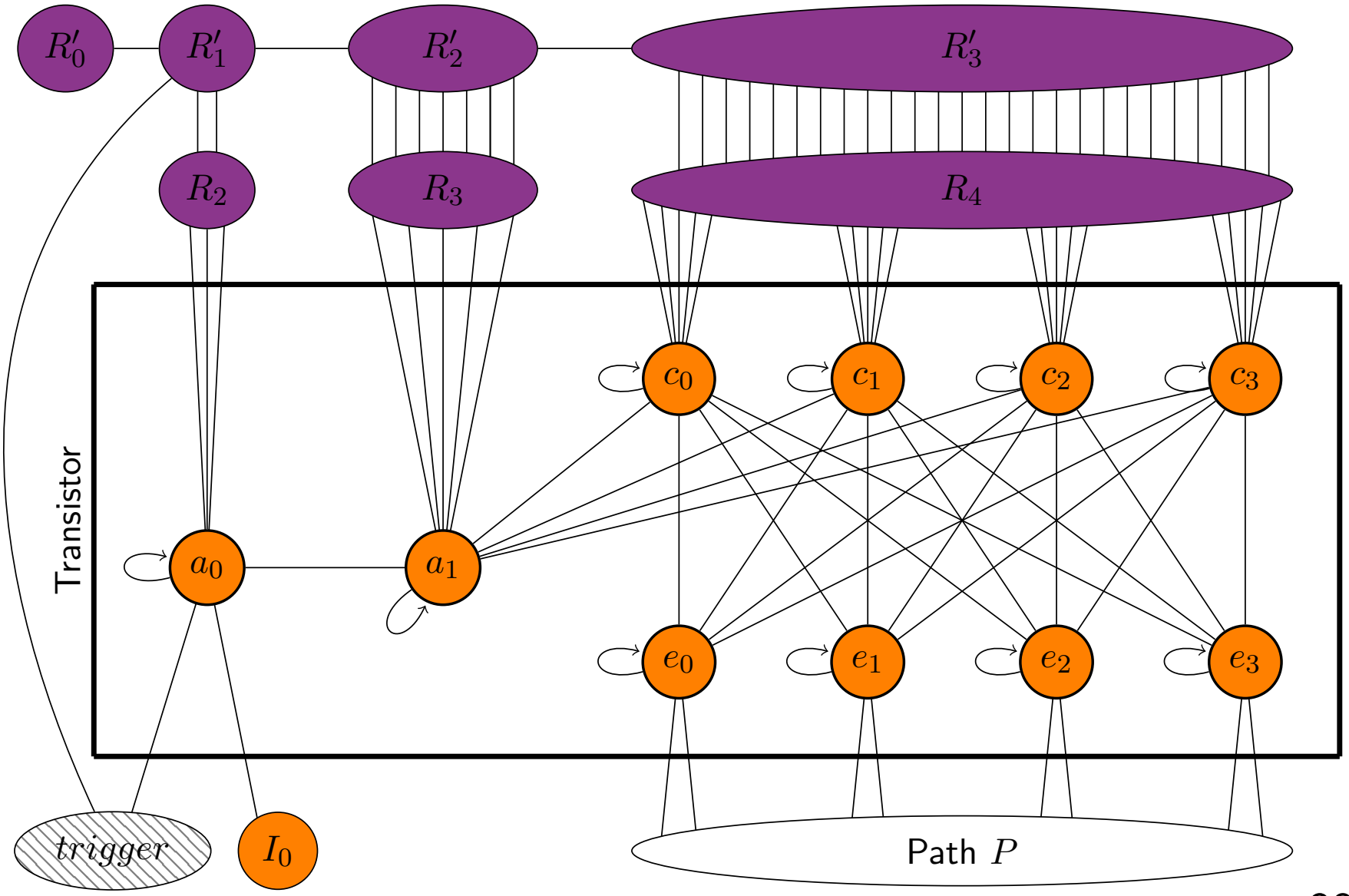

R_2
R_3
R_3
R_4
c_0
c_1
c_2
c_3
Collector Nodes
a_2
a_1
a_0
e_0
e_1
e_2
e_3
Emitter Nodes
Transistor
Base Nodes
I_0
Path P

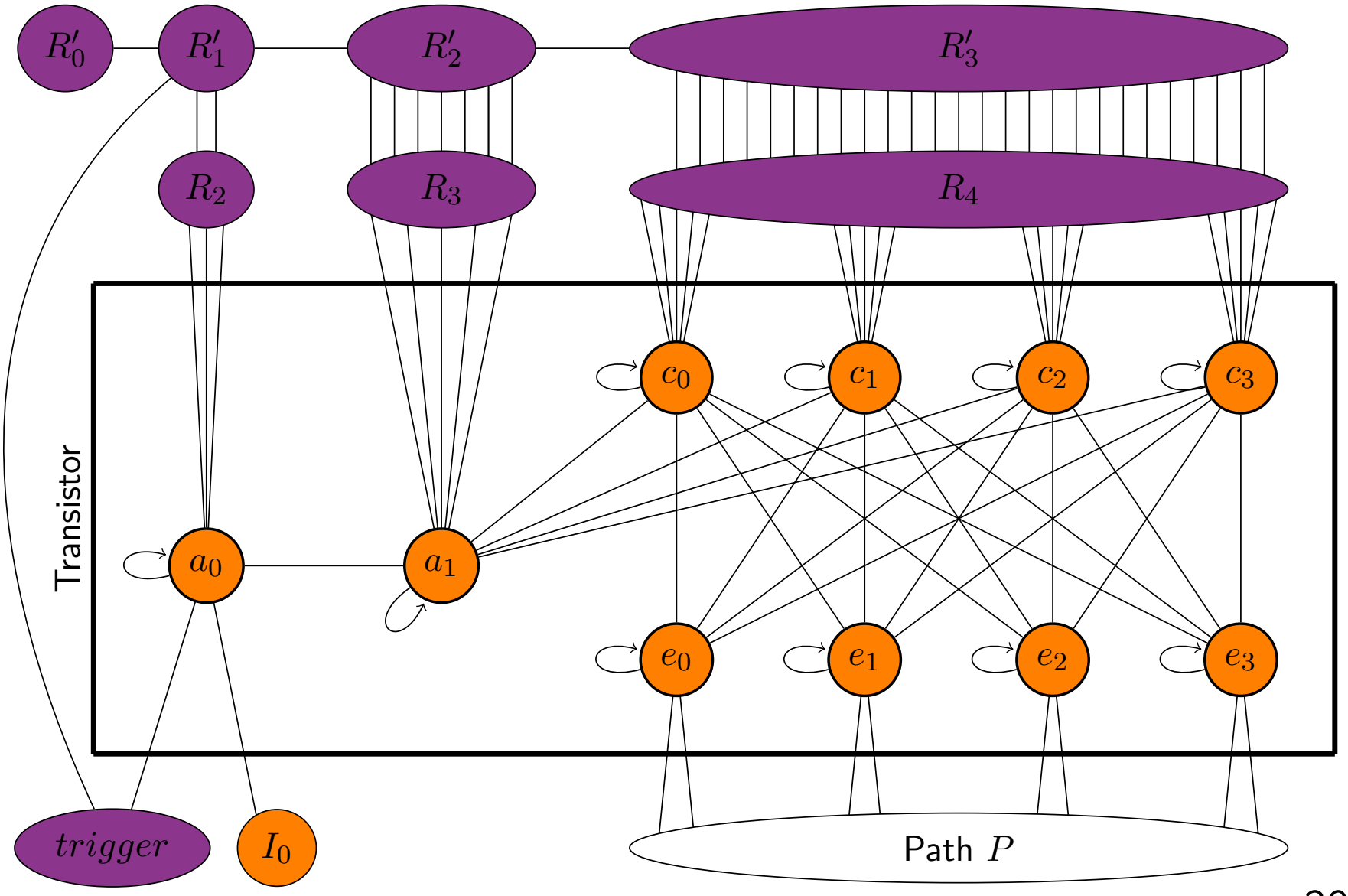

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

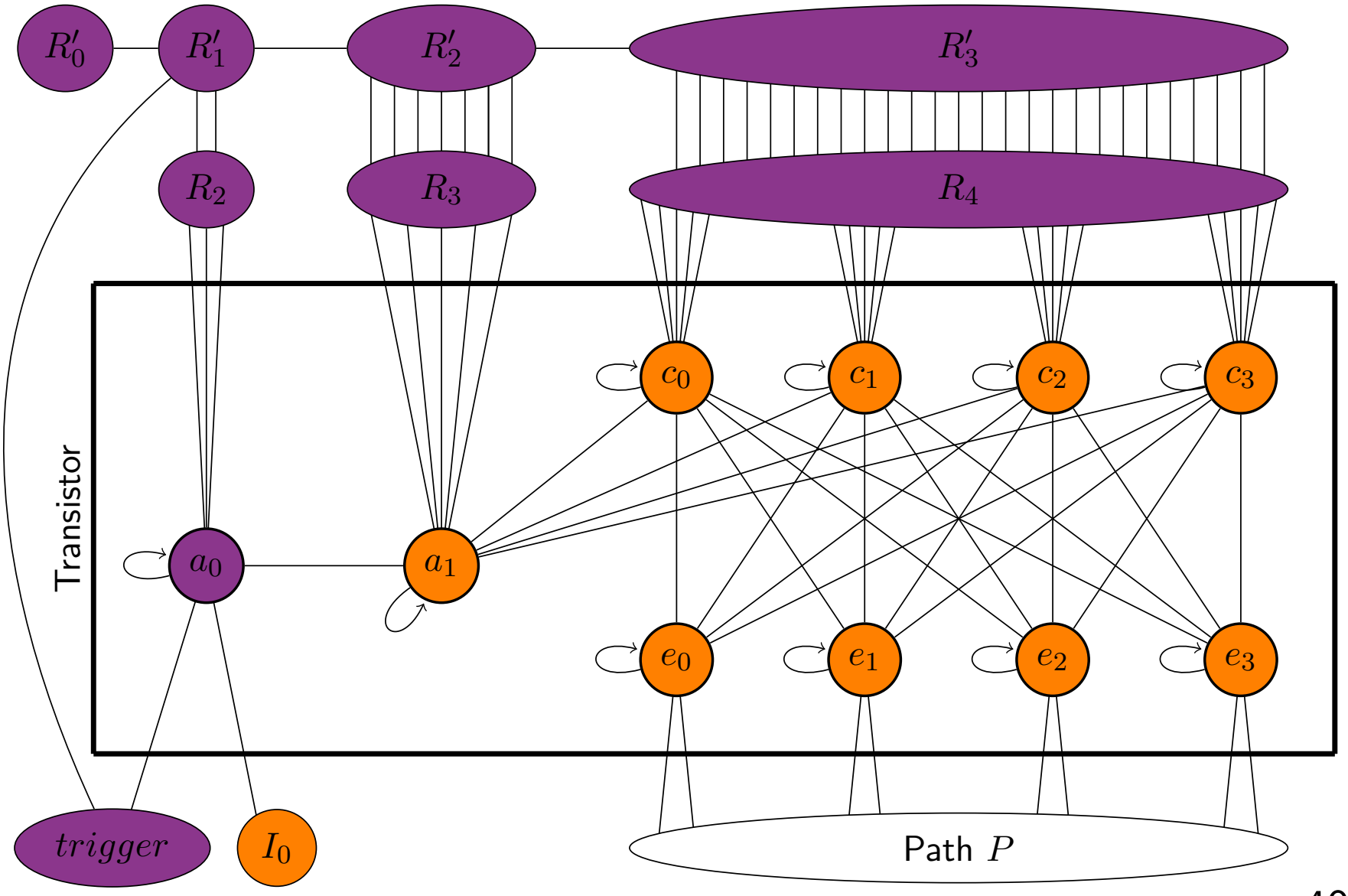

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

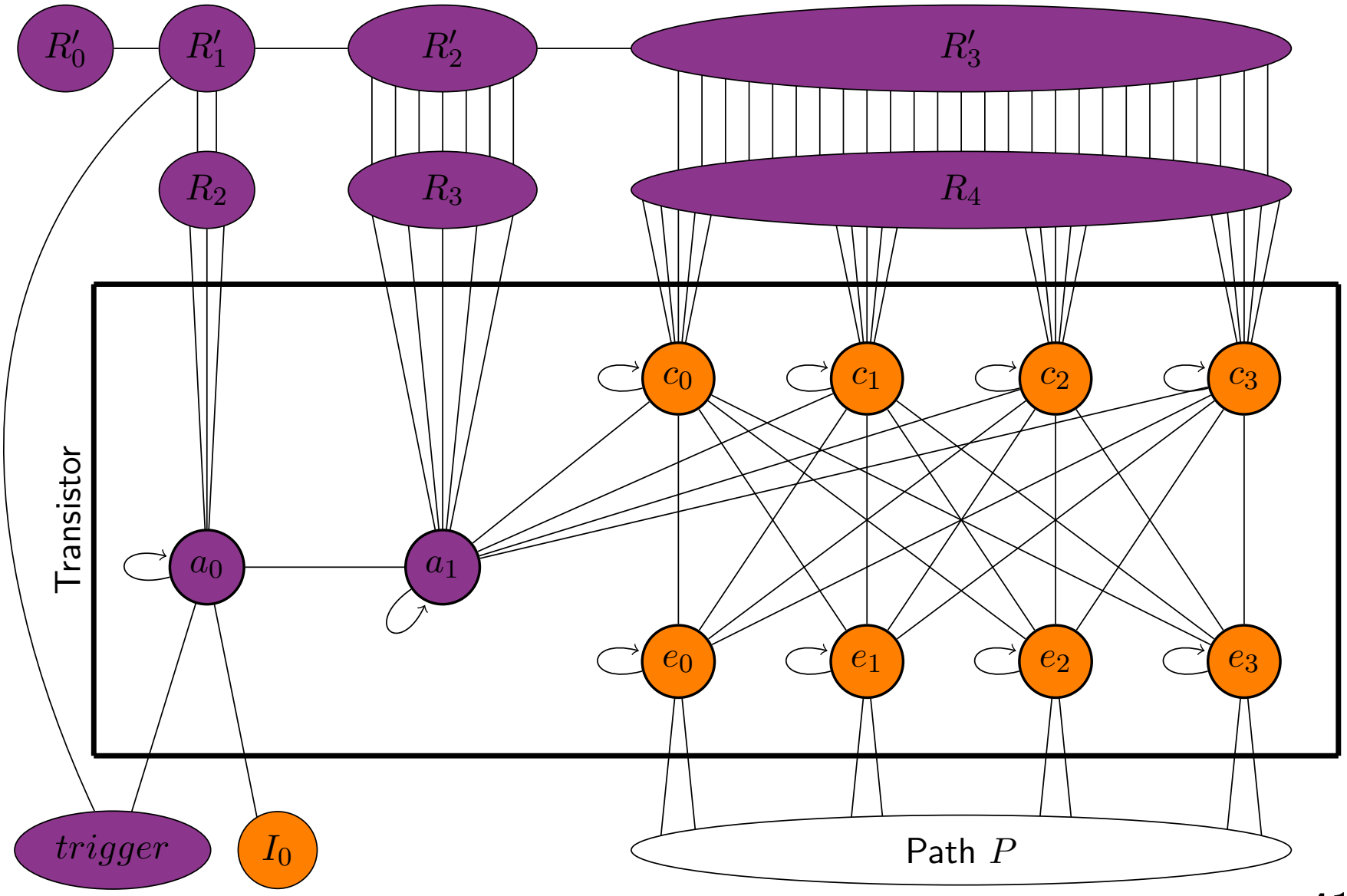

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

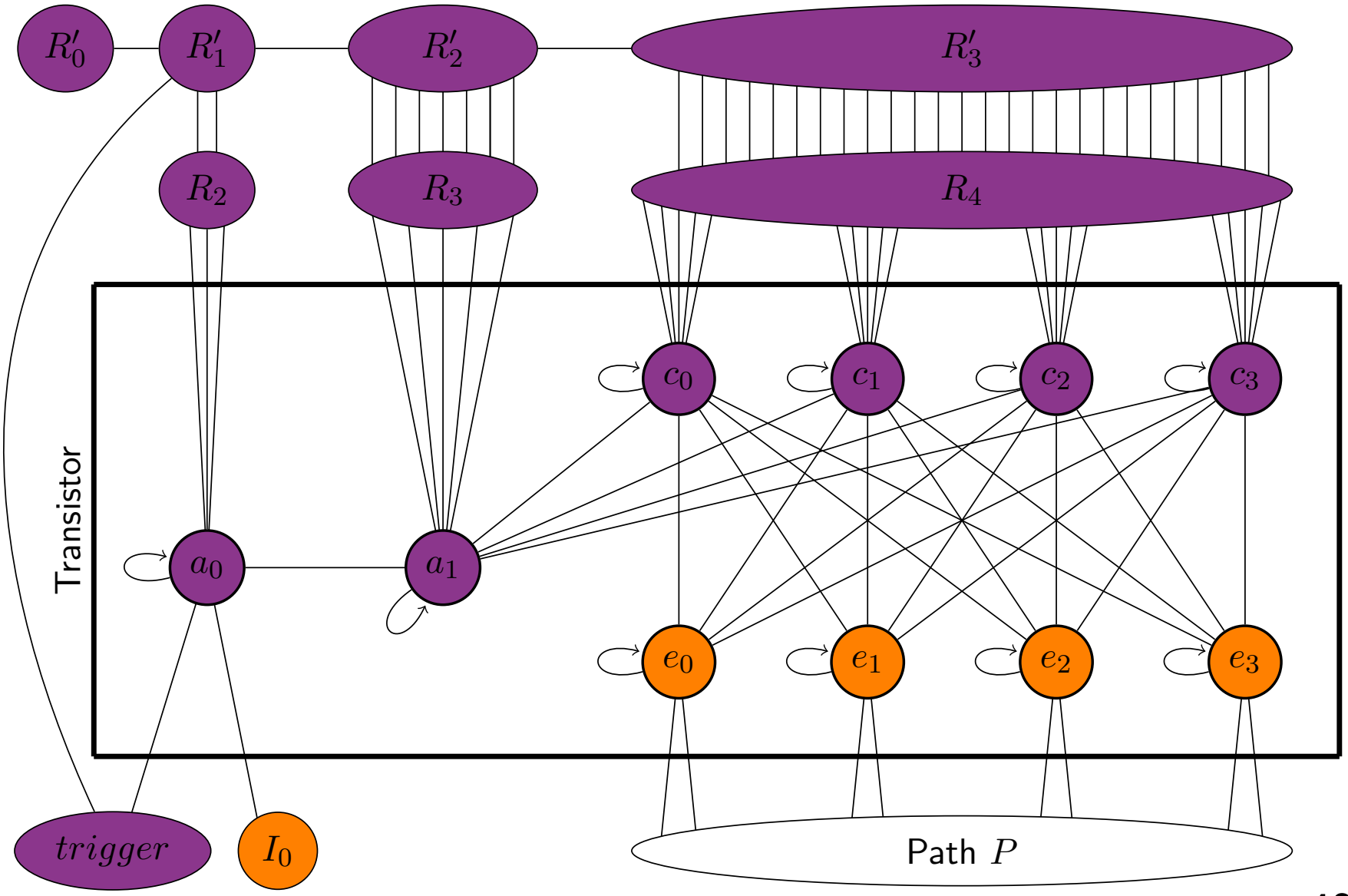

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

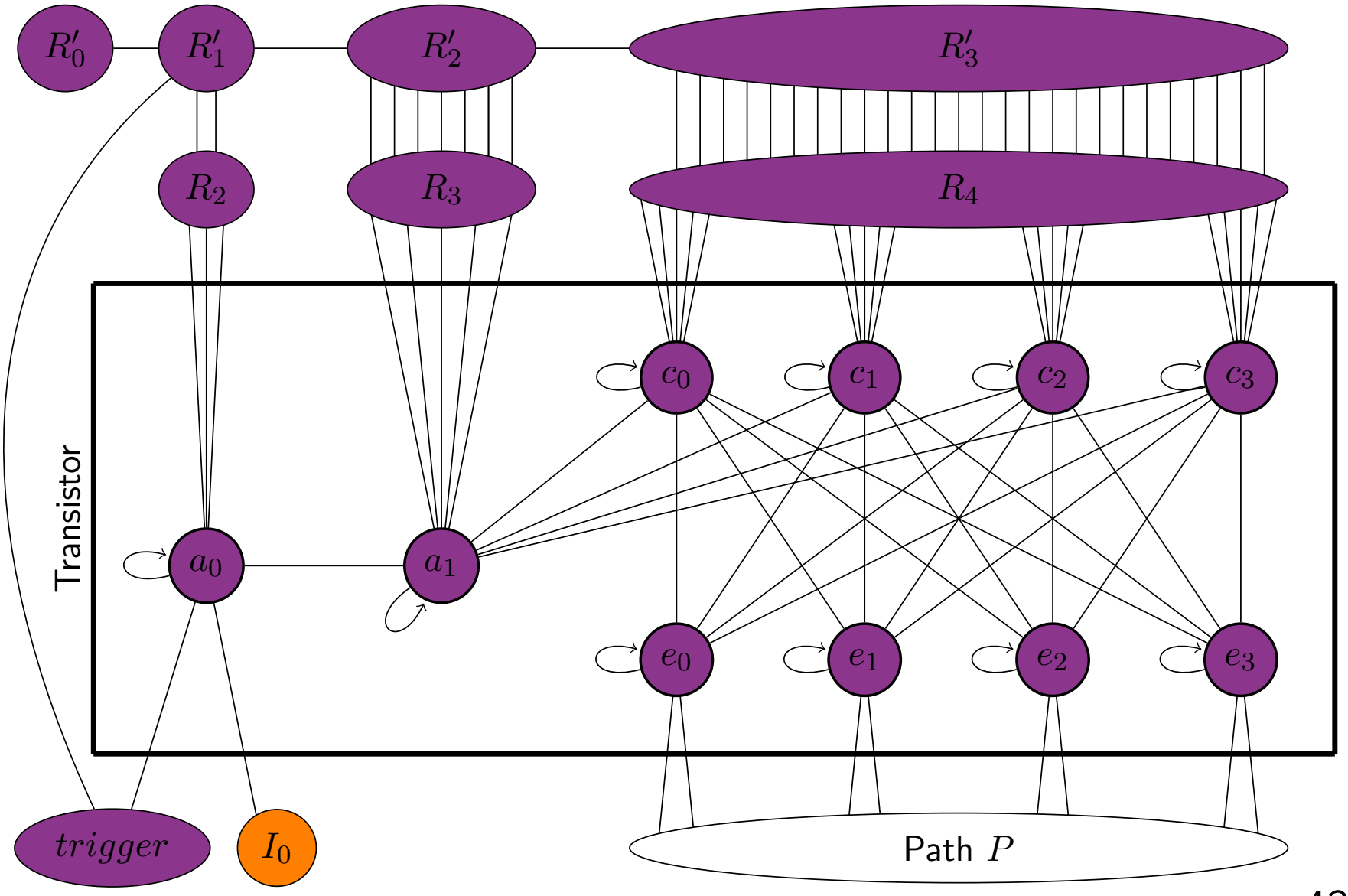

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

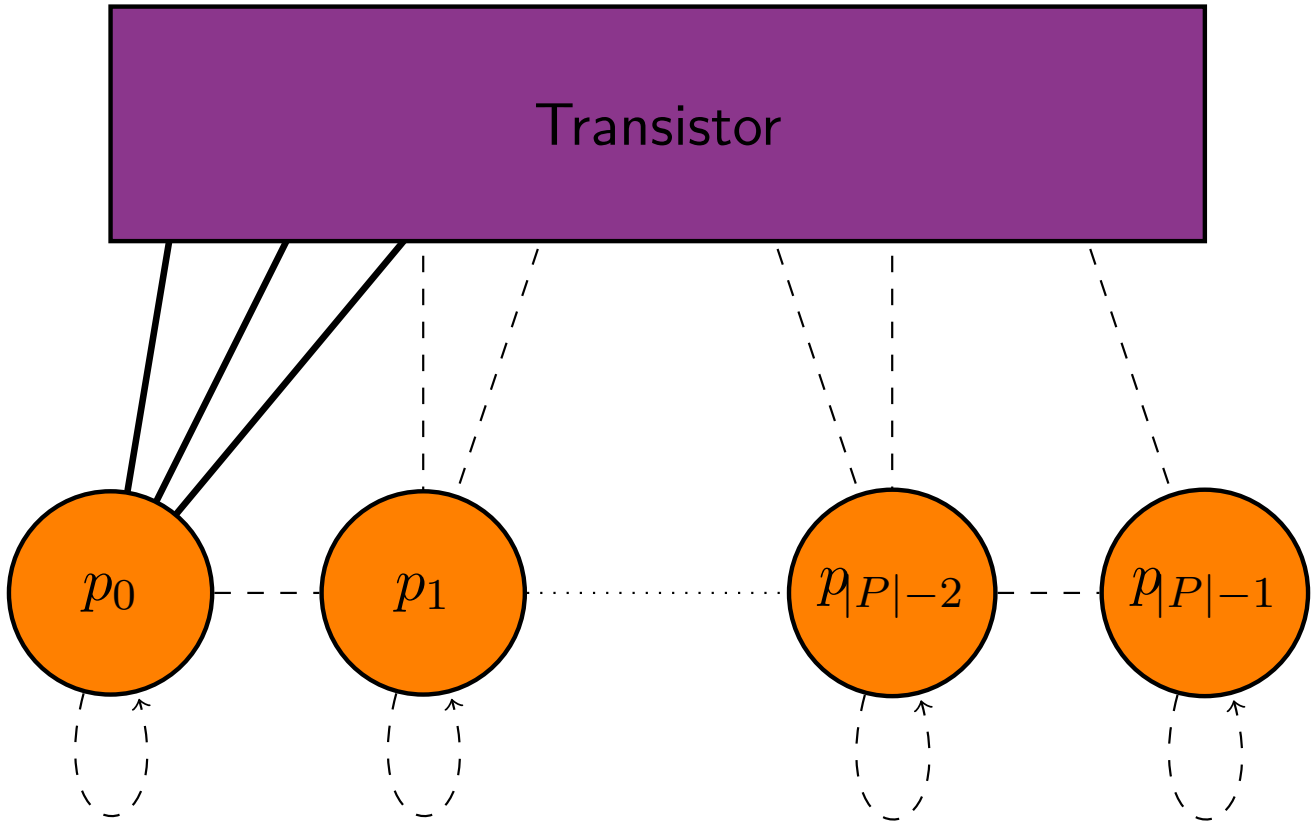

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

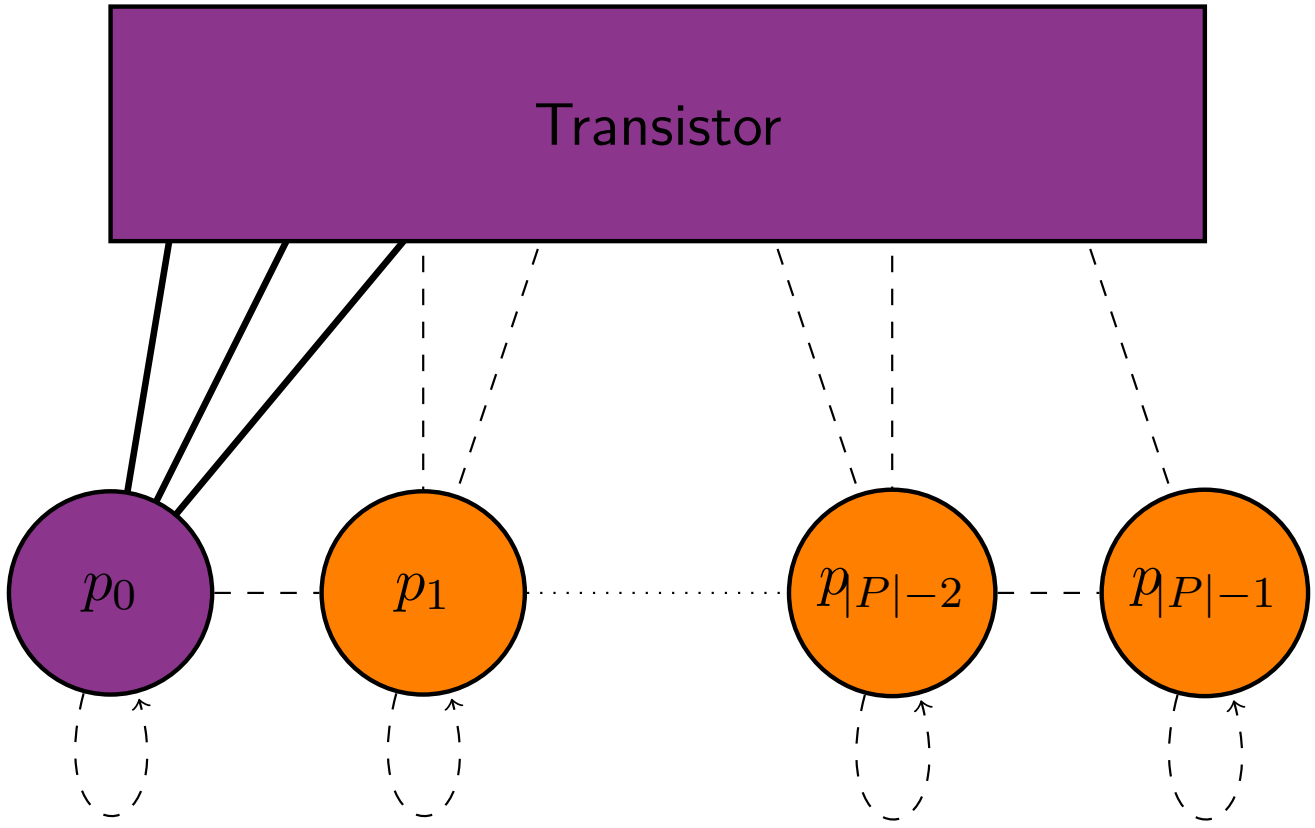

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

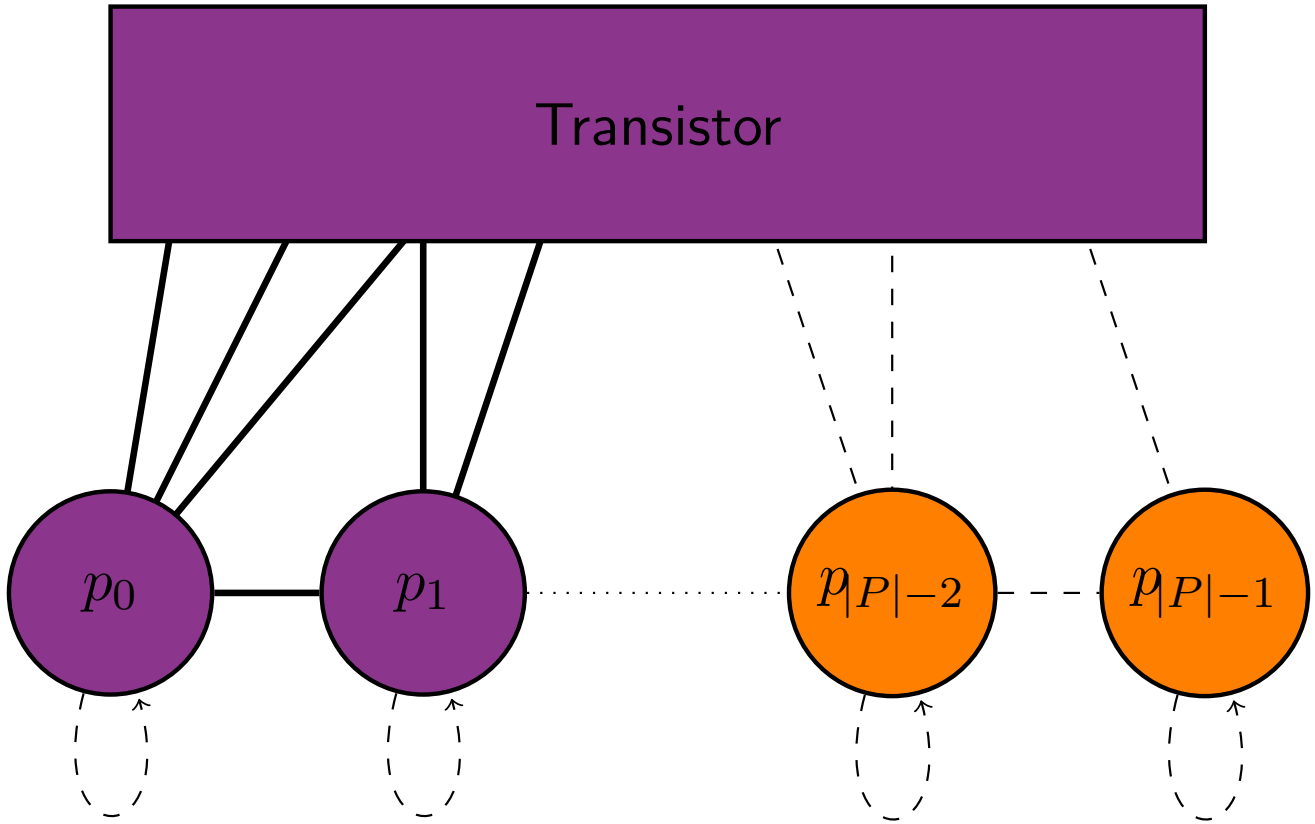

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

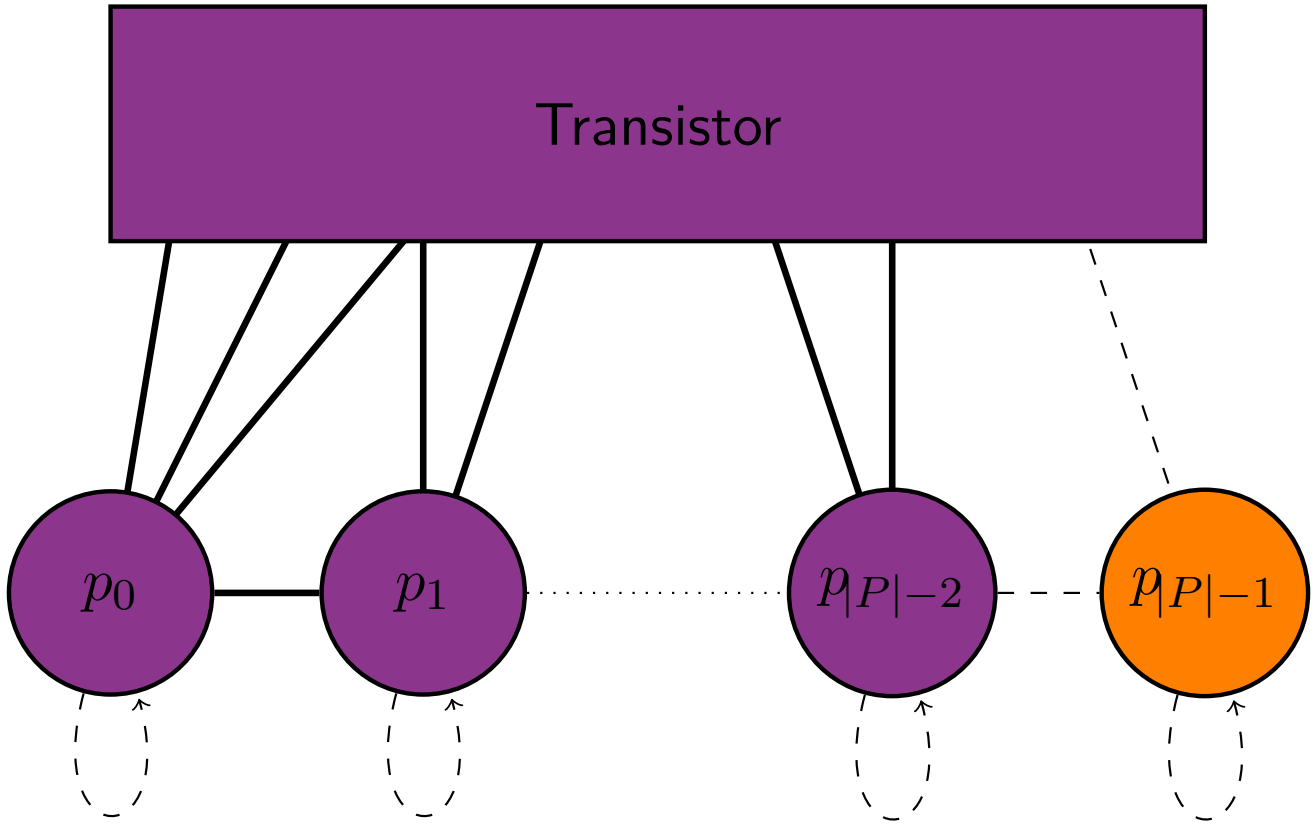

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

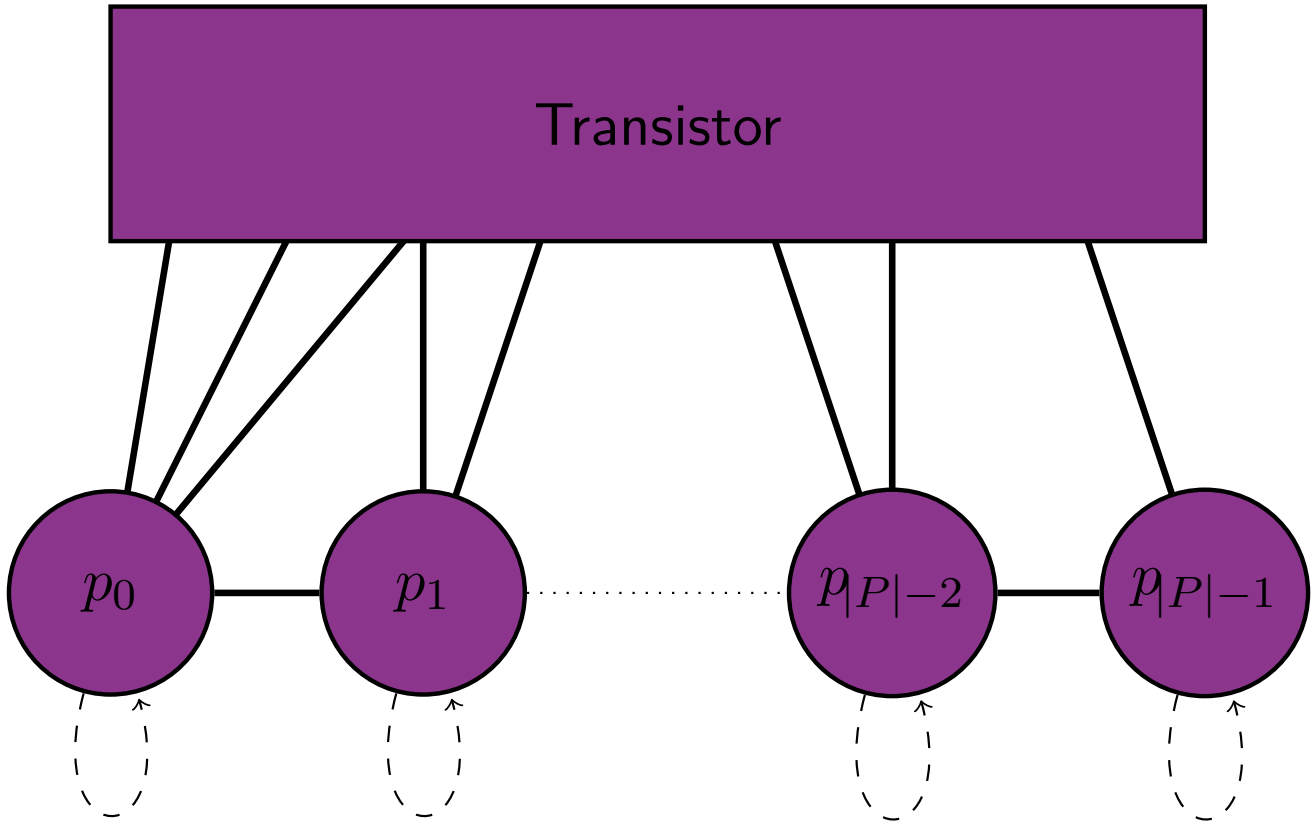

R'_0
R'_1
R'_2
R'_3
R_2
R_3
R_4
Transistor
c_0
c_1
c_2
c_3
a_0
a_1
e_0
e_1
e_2
e_3
$trigger$
I_0
Path P

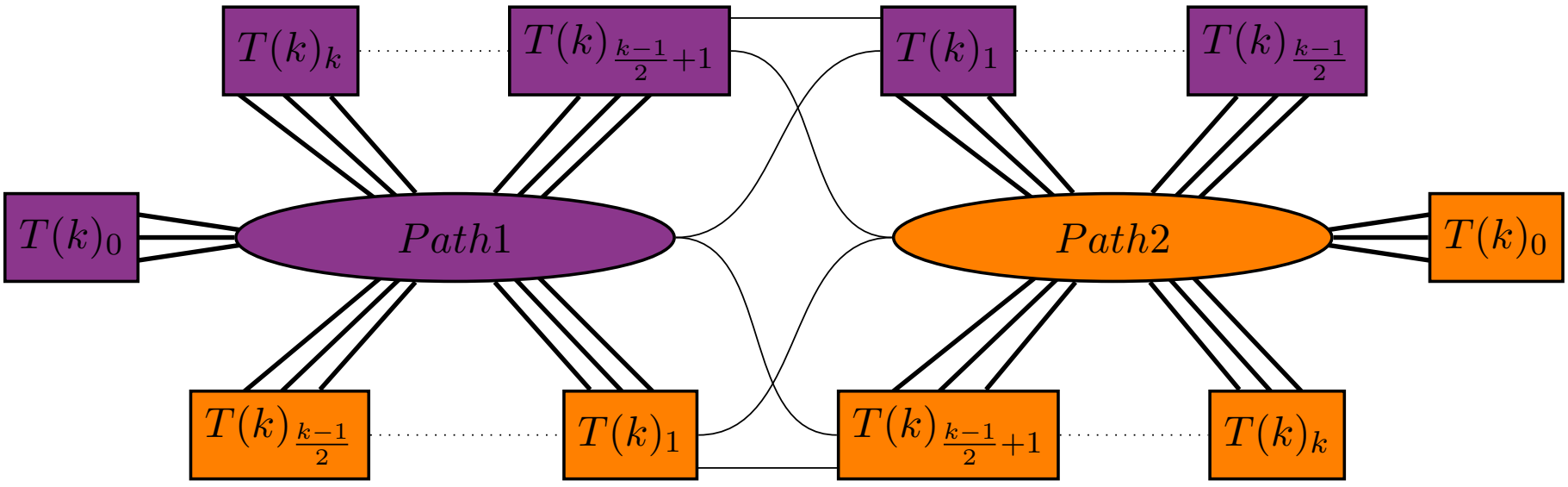

Transistor
p_0
p_1
$p_{|P|-2}$
$p_{|P|-1}$

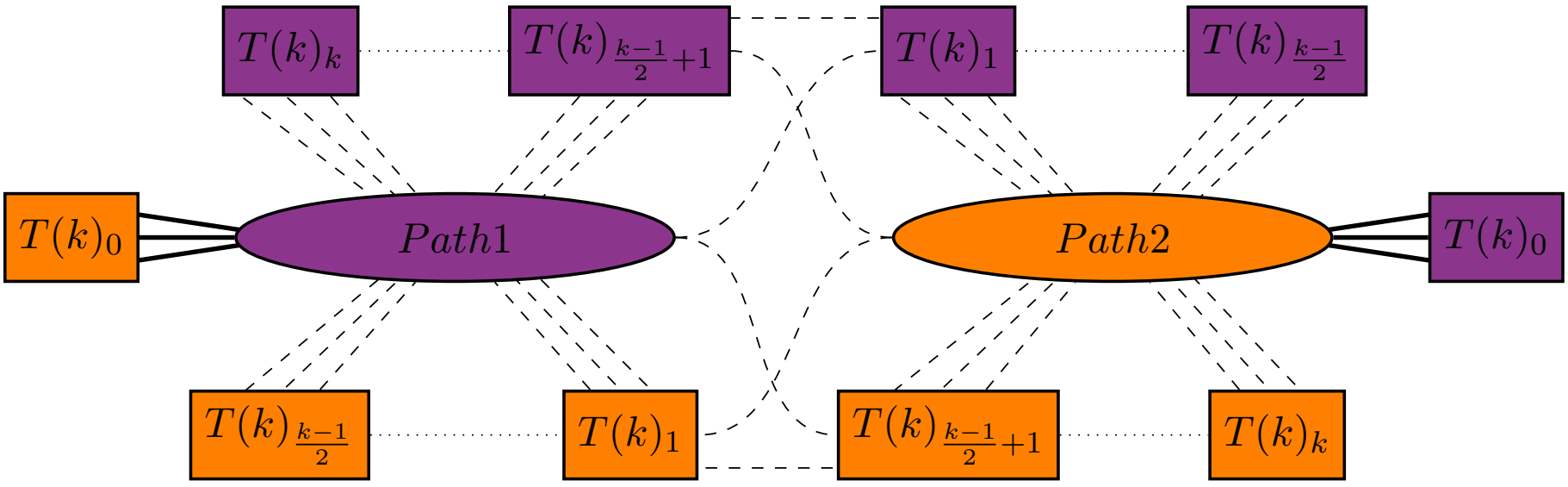

Transistor
p_0
p_1
$p_{|P|-2}$
$p_{|P|-1}$

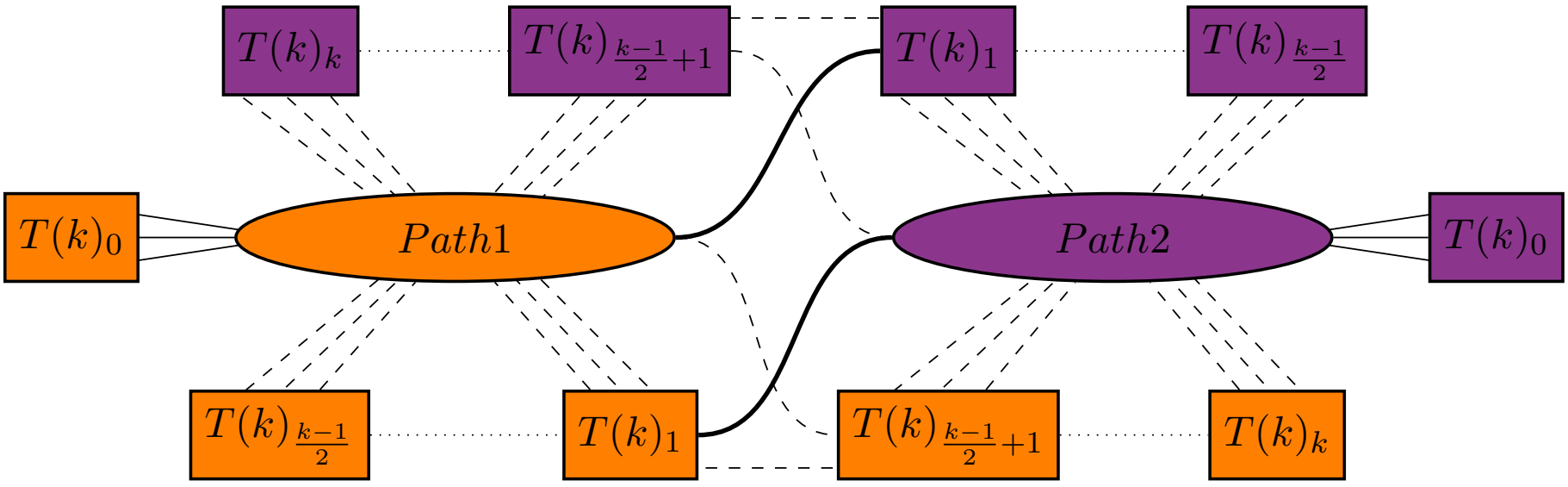

Transistor
p_0
p_1
$p_{|P|-2}$
$p_{|P|-1}$

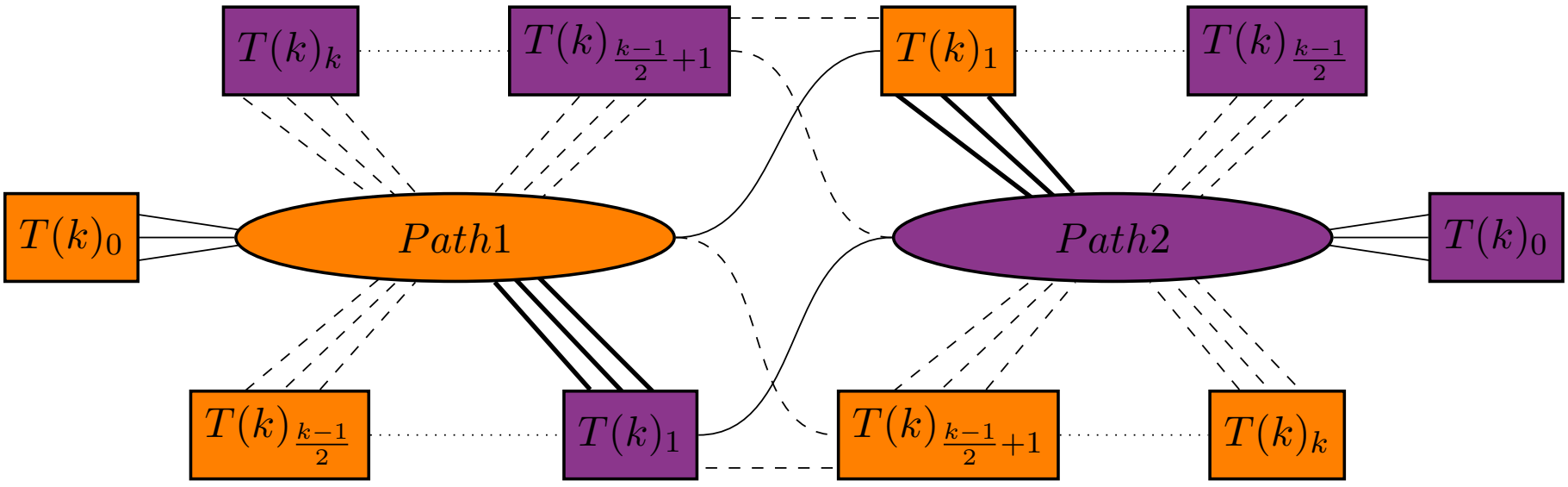

Transistor
p_0
p_1
$p_{|P|-2}$
$p_{|P|-1}$

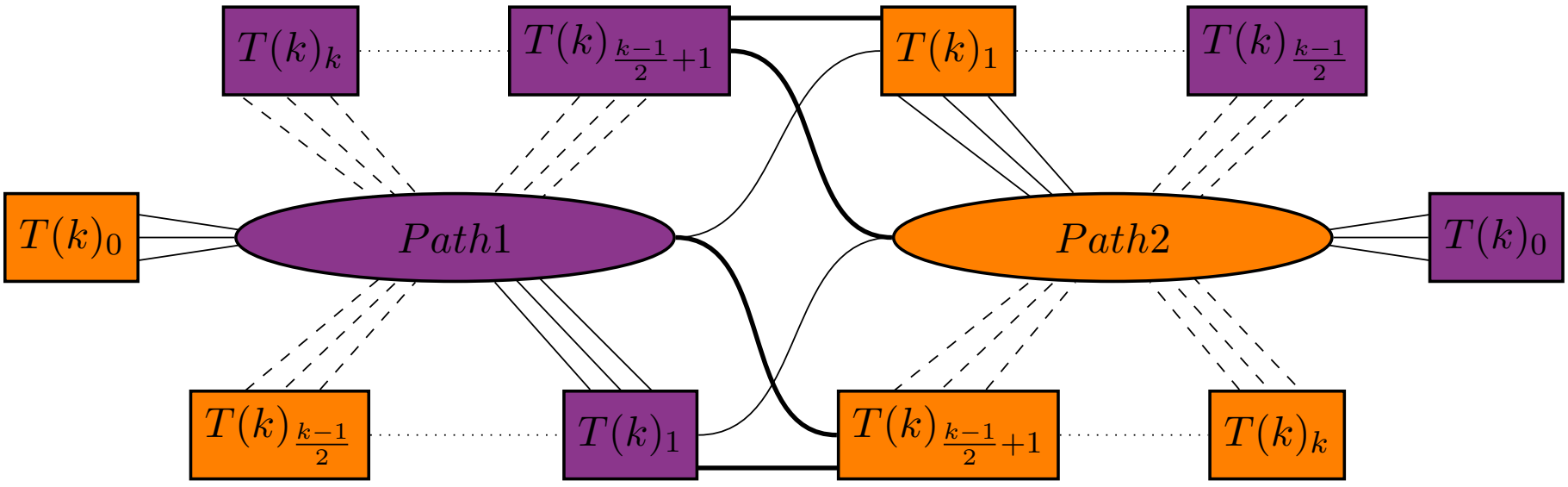

Transistor
p_0
p_1
$p_{|P|-2}$
$p_{|P|-1}$

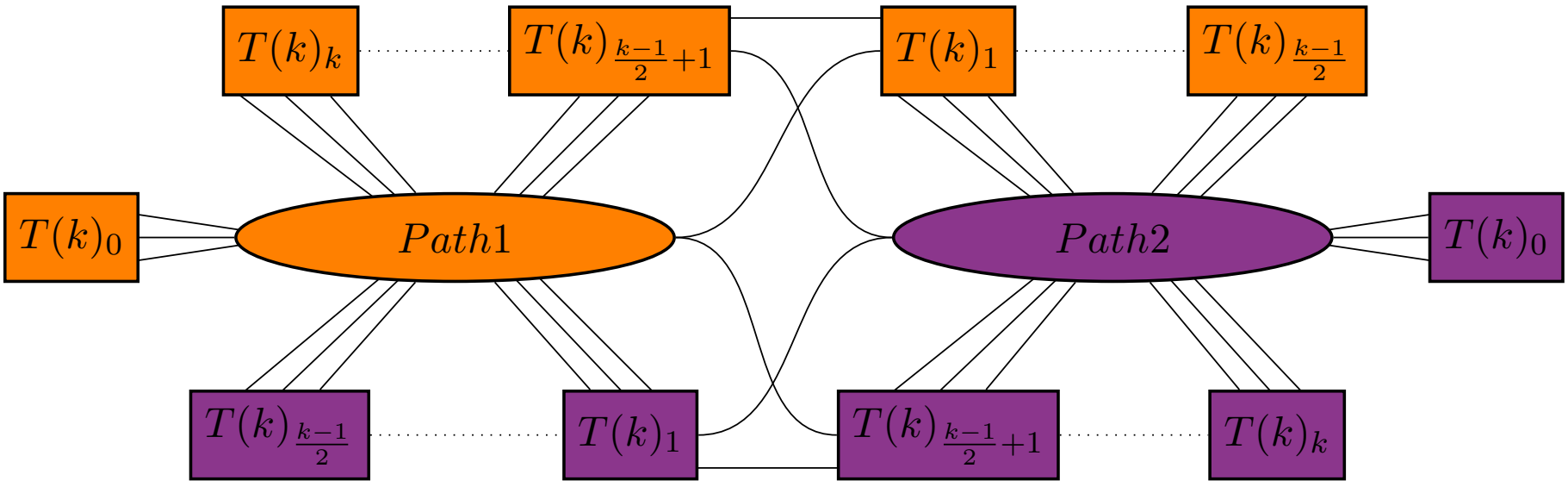

$T(k)_k$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}}$
$T(k)_0$
$Path1$
$Path2$
$T(k)_0$
$T(k)_{\frac{k-1}{2}}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_k$


$T(k)_k$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}}$
$T(k)_0$
$Path1$
$Path2$
$T(k)_0$
$T(k)_{\frac{k-1}{2}}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_k$


$T(k)_k$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}}$
$T(k)_0$
$Path1$
$Path2$
$T(k)_0$
$T(k)_{\frac{k-1}{2}}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_k$


$T(k)_k$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}}$
$T(k)_0$
$Path1$
$Path2$
$T(k)_0$
$T(k)_{\frac{k-1}{2}}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_k$


$T(k)_k$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}}$
$T(k)_0$
$Path1$
$Path2$
$T(k)_0$
$T(k)_{\frac{k-1}{2}}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_k$


$T(k)_k$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}}$
$T(k)_0$
$Path1$
$Path2$
$T(k)_0$
$T(k)_{\frac{k-1}{2}}$
$T(k)_1$
$T(k)_{\frac{k-1}{2}+1}$
$T(k)_k$

Future Work

- Periodic stability
- Increase certainty
- More than two experts

Questions?