Aalto University

Distributed Algorithms 2020

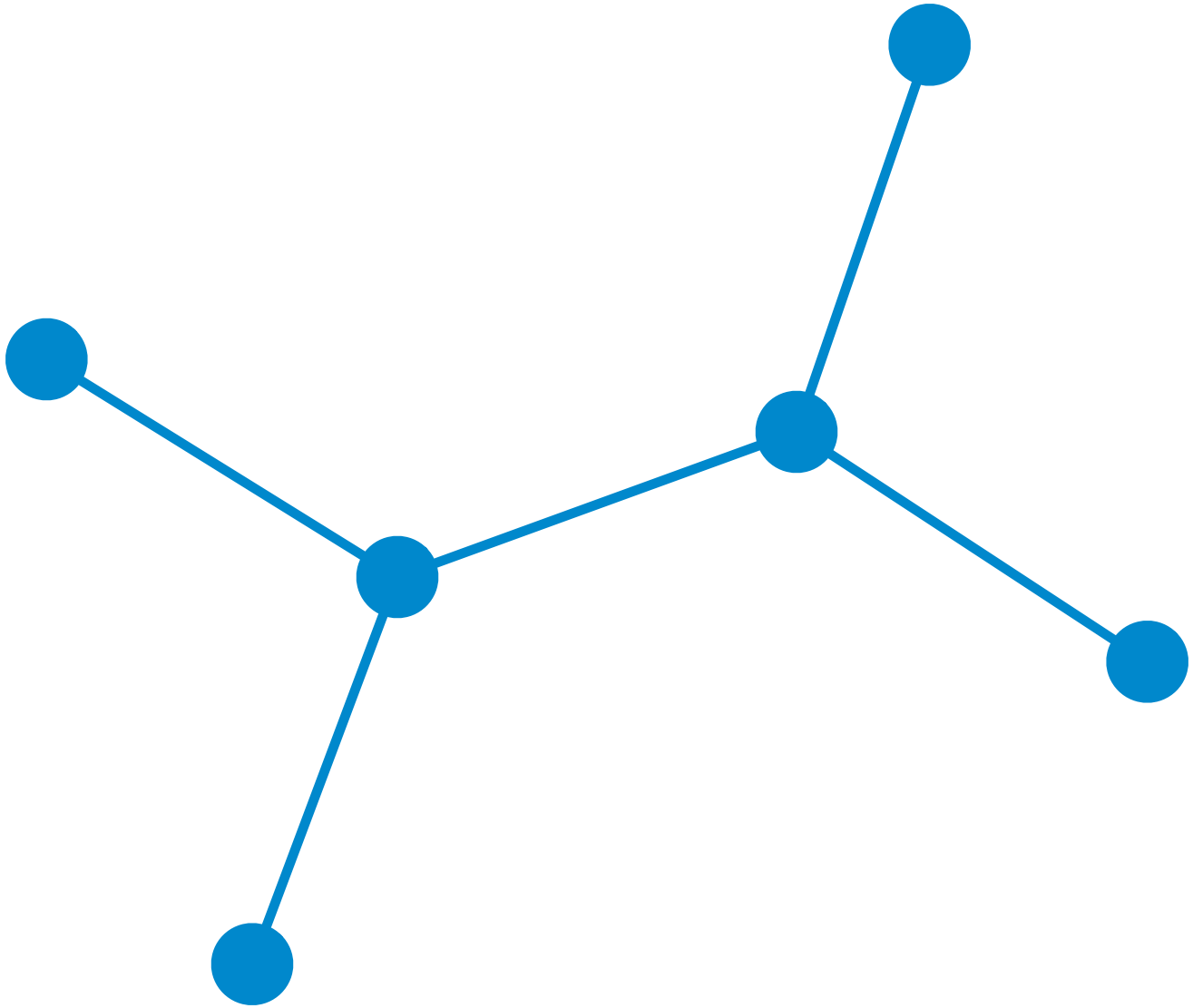
3a Port-numbering model

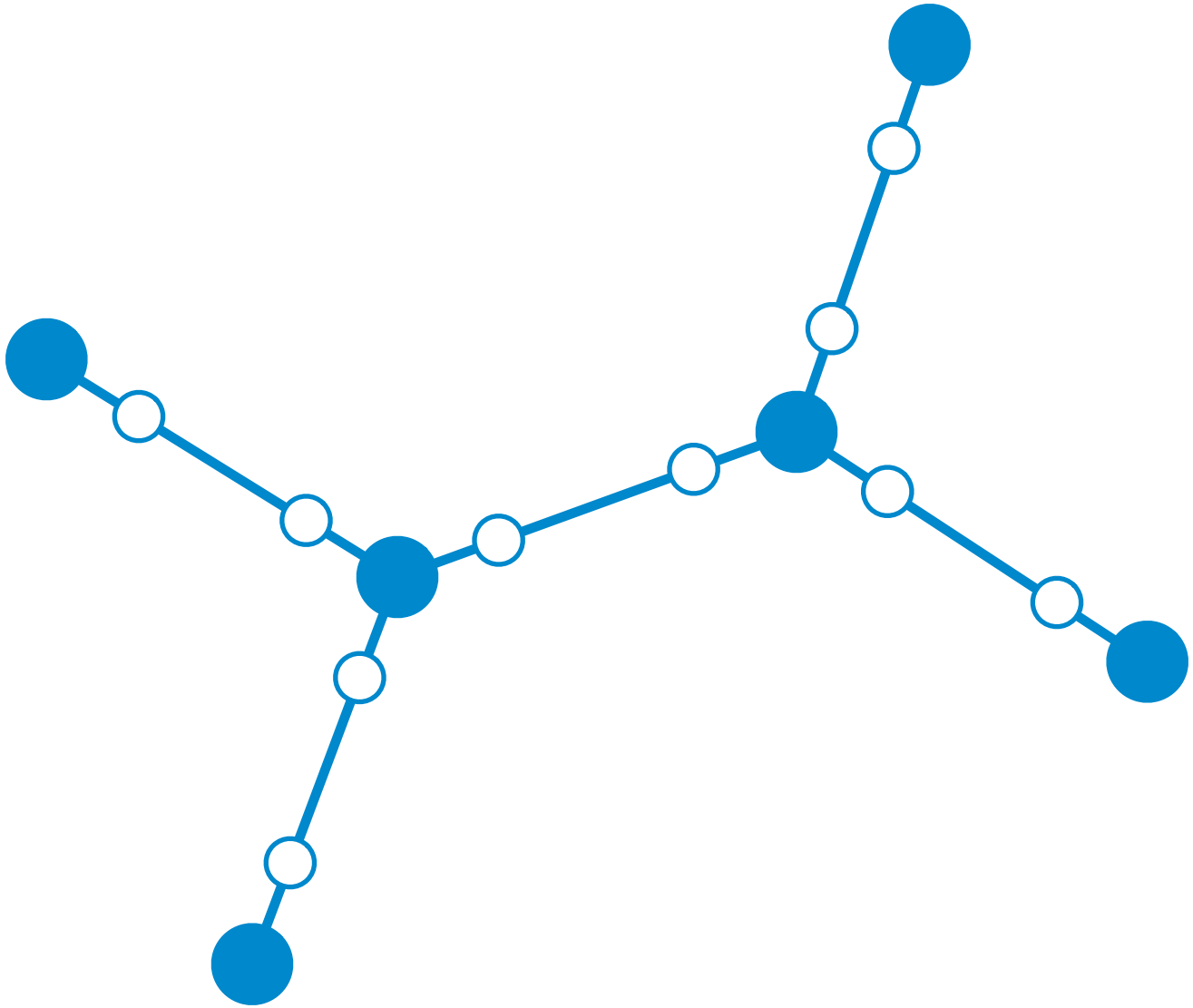
This week: formal definition of ***port-numbering model***

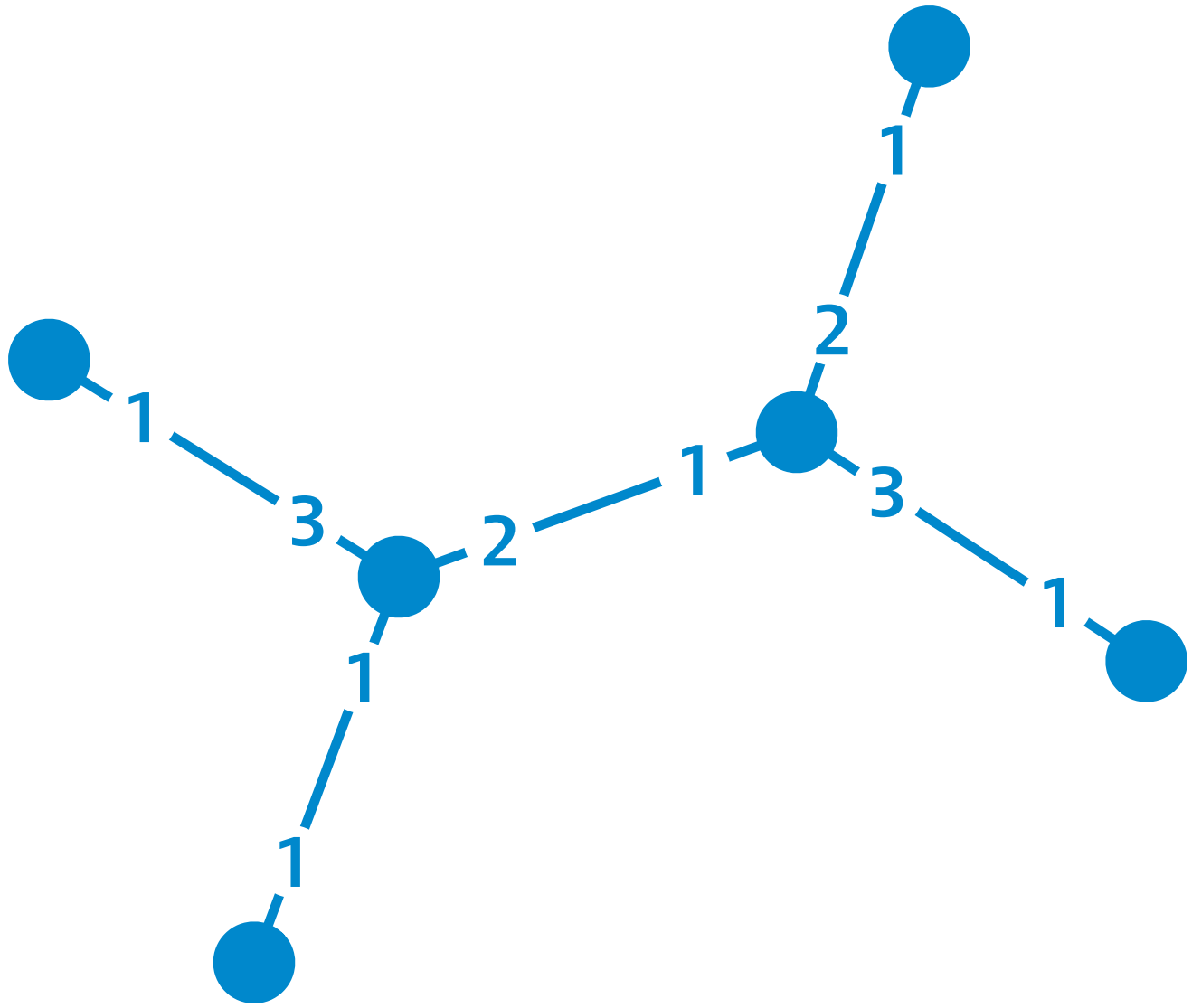
- "PN model"
- simple and weak

Coming weeks: extensions and variants of PN model

+ unique identifiers = **LOCAL** model
+ message size limit = **CONGEST** model



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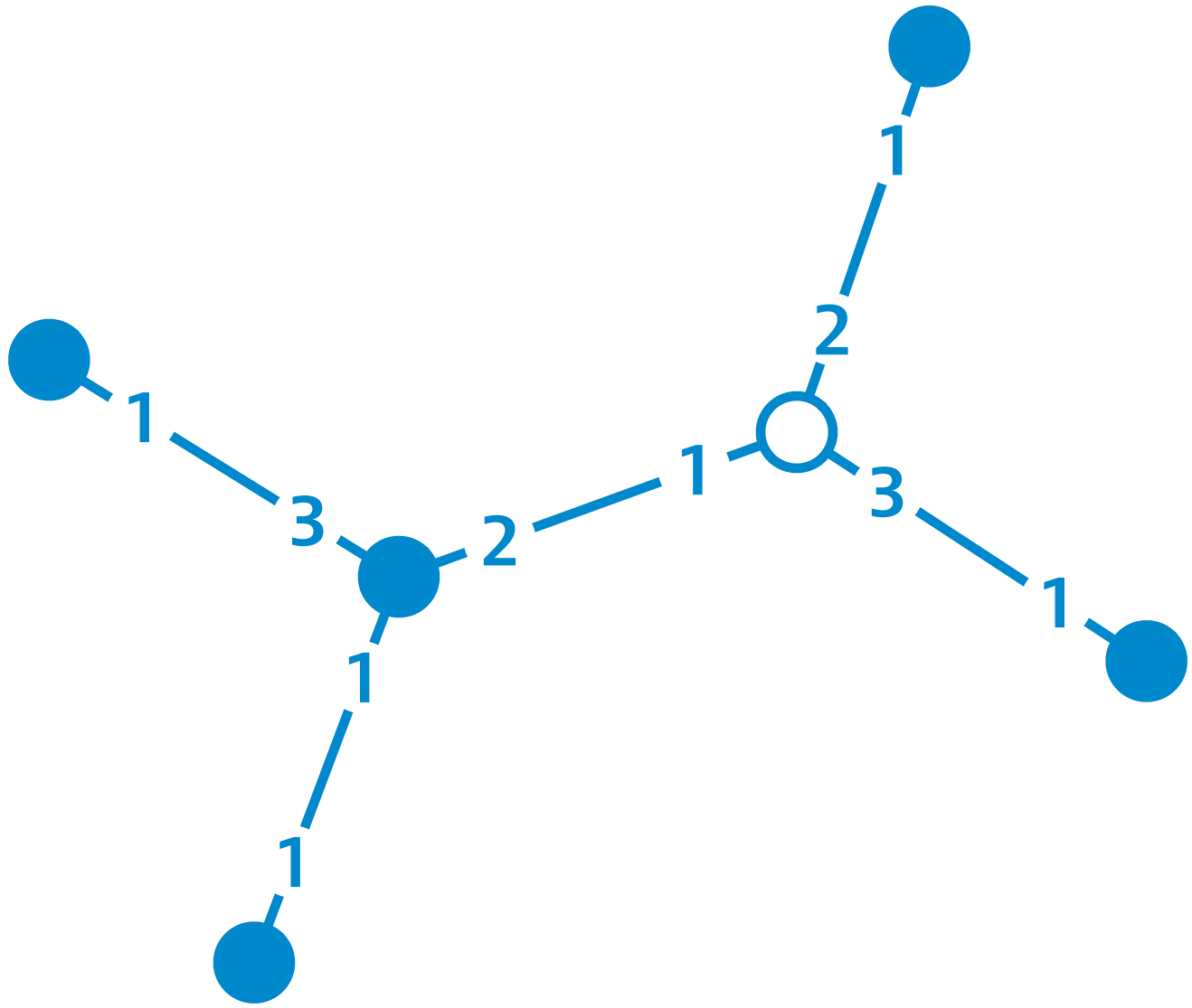
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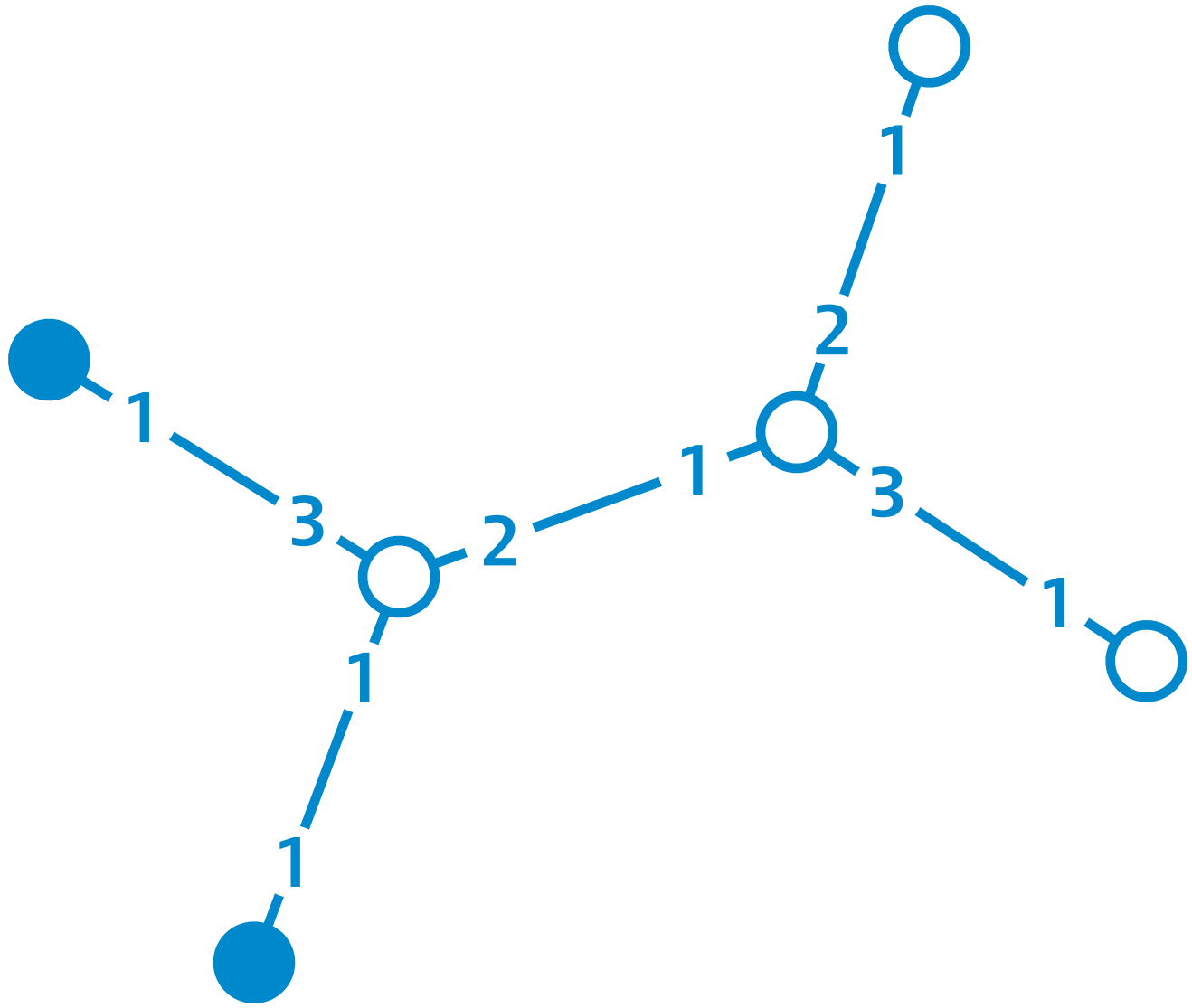
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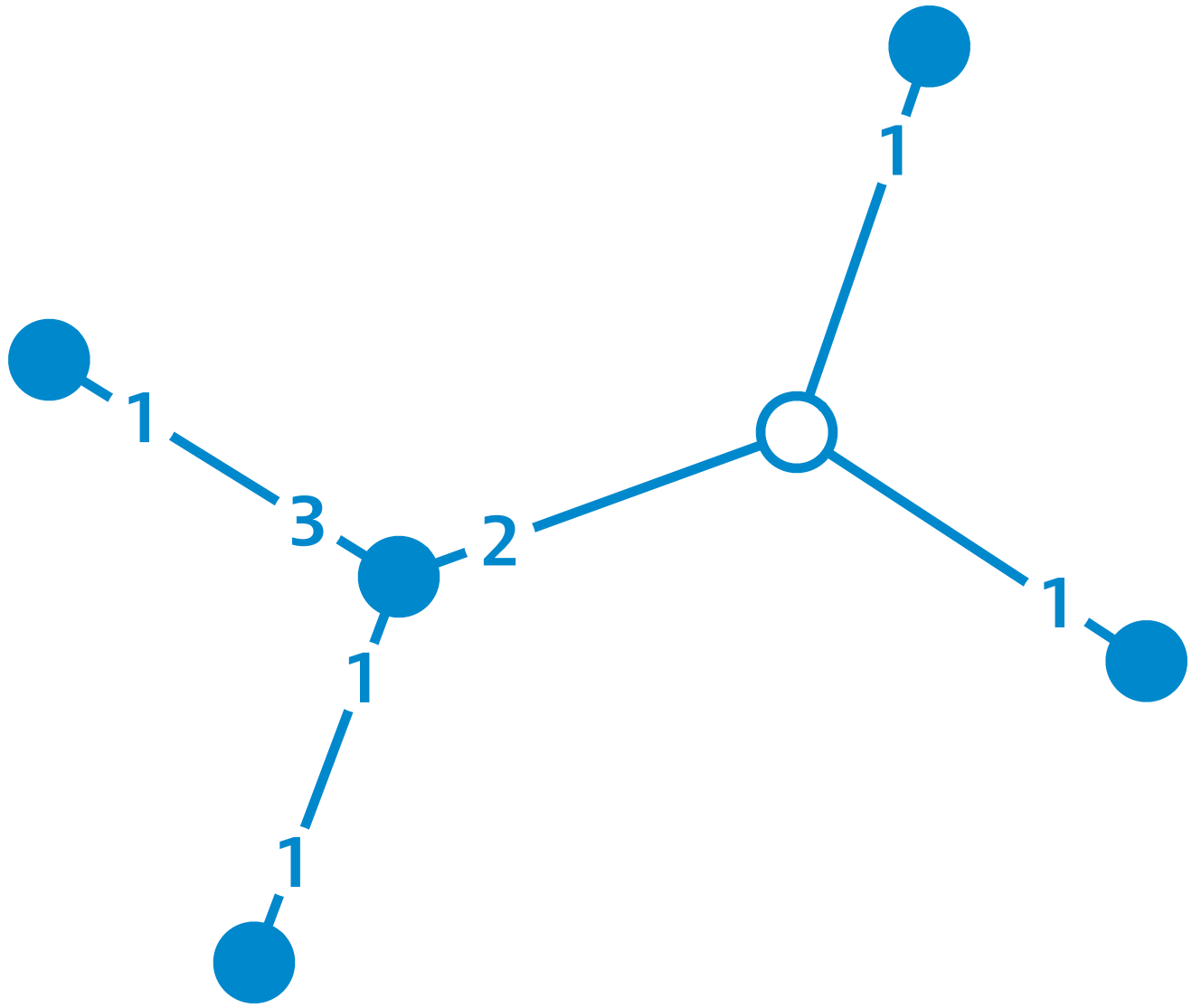
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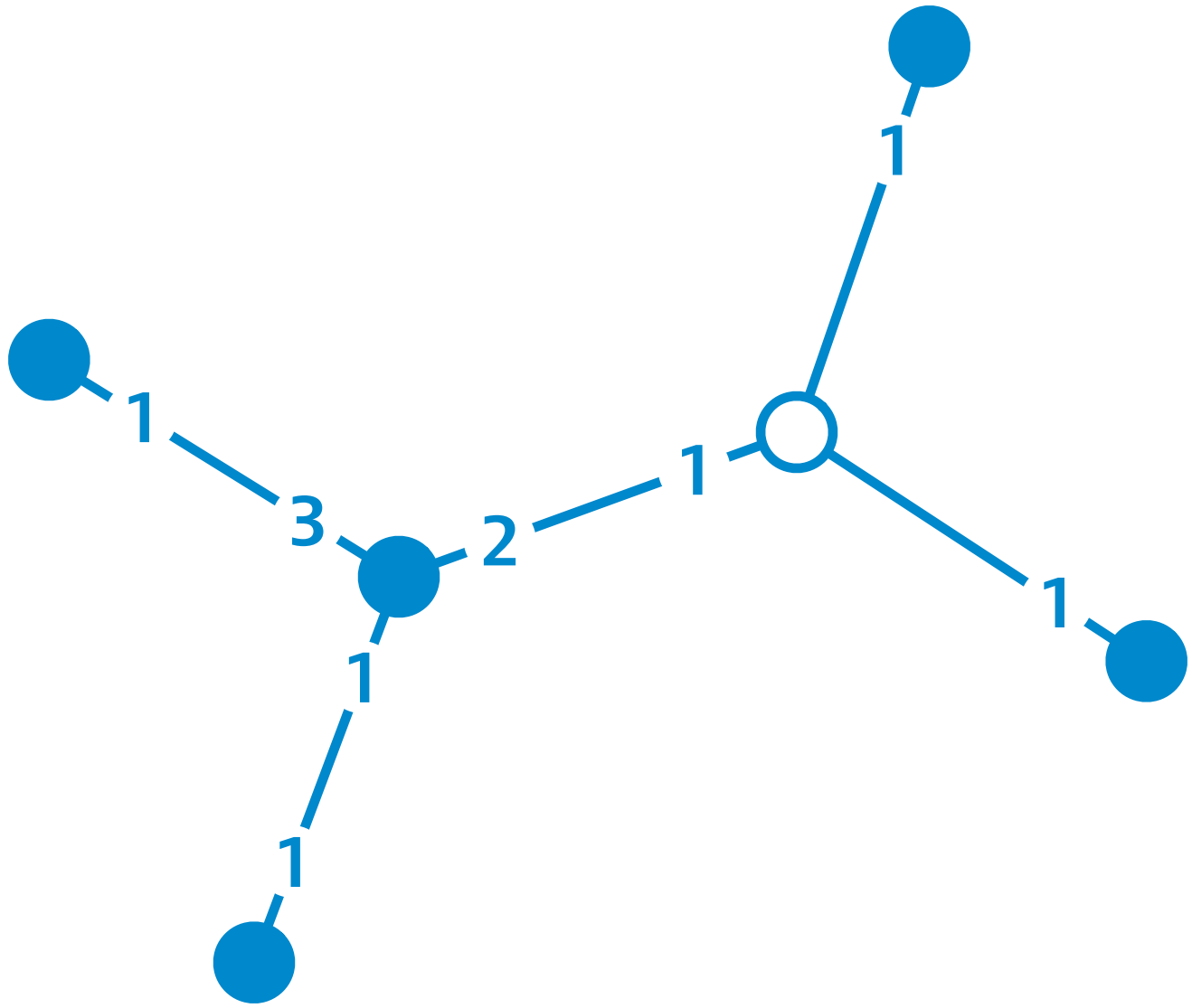
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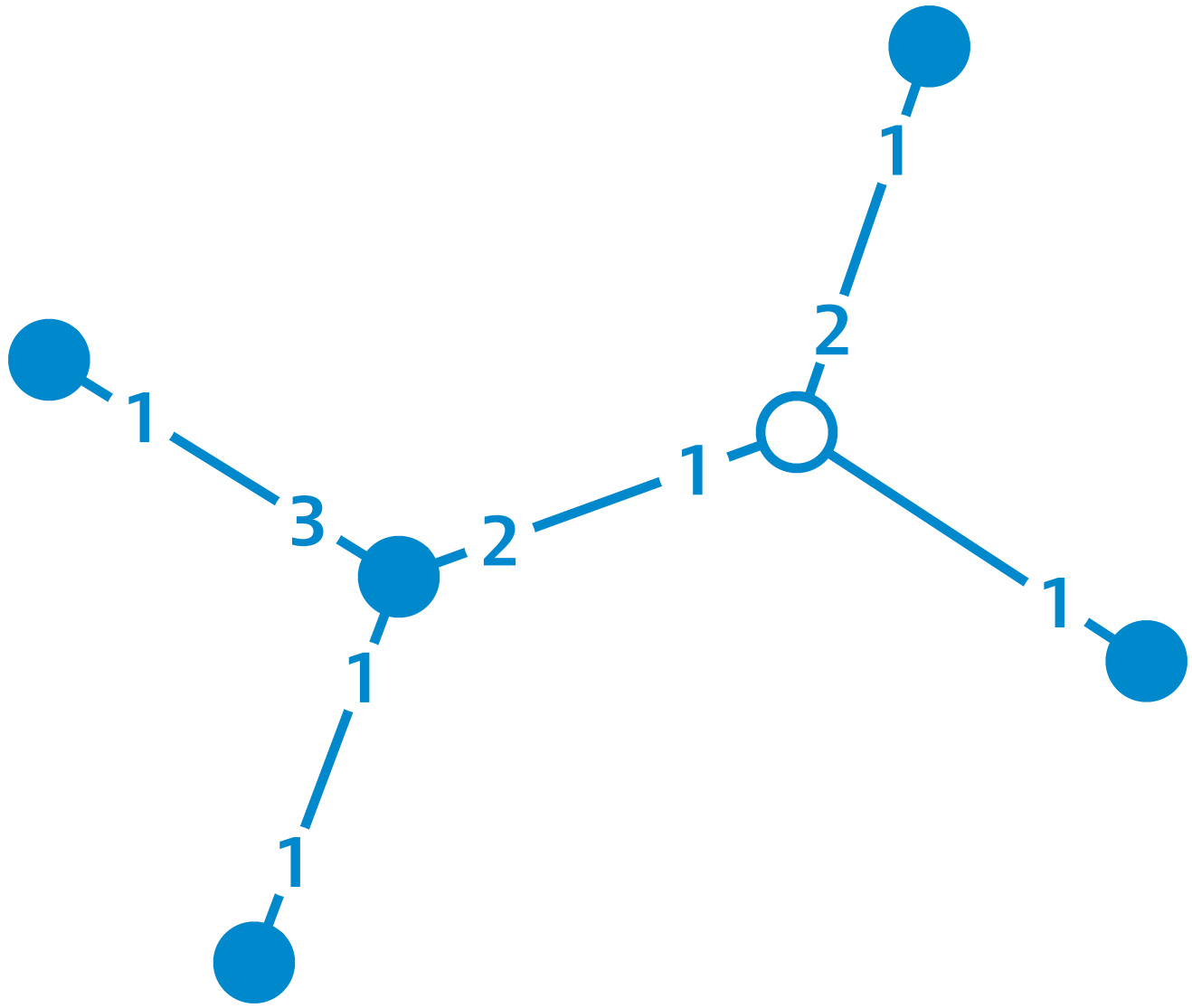
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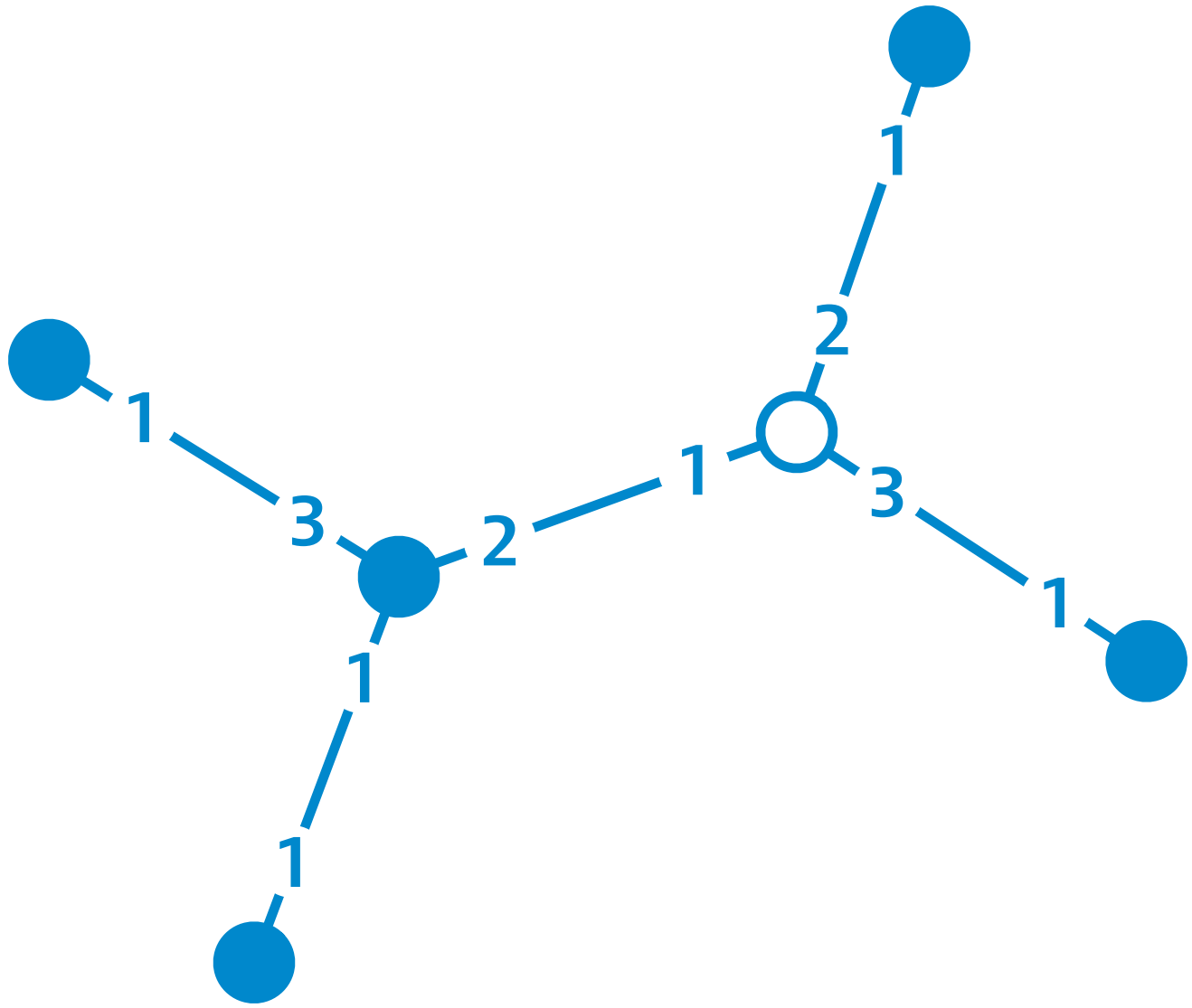
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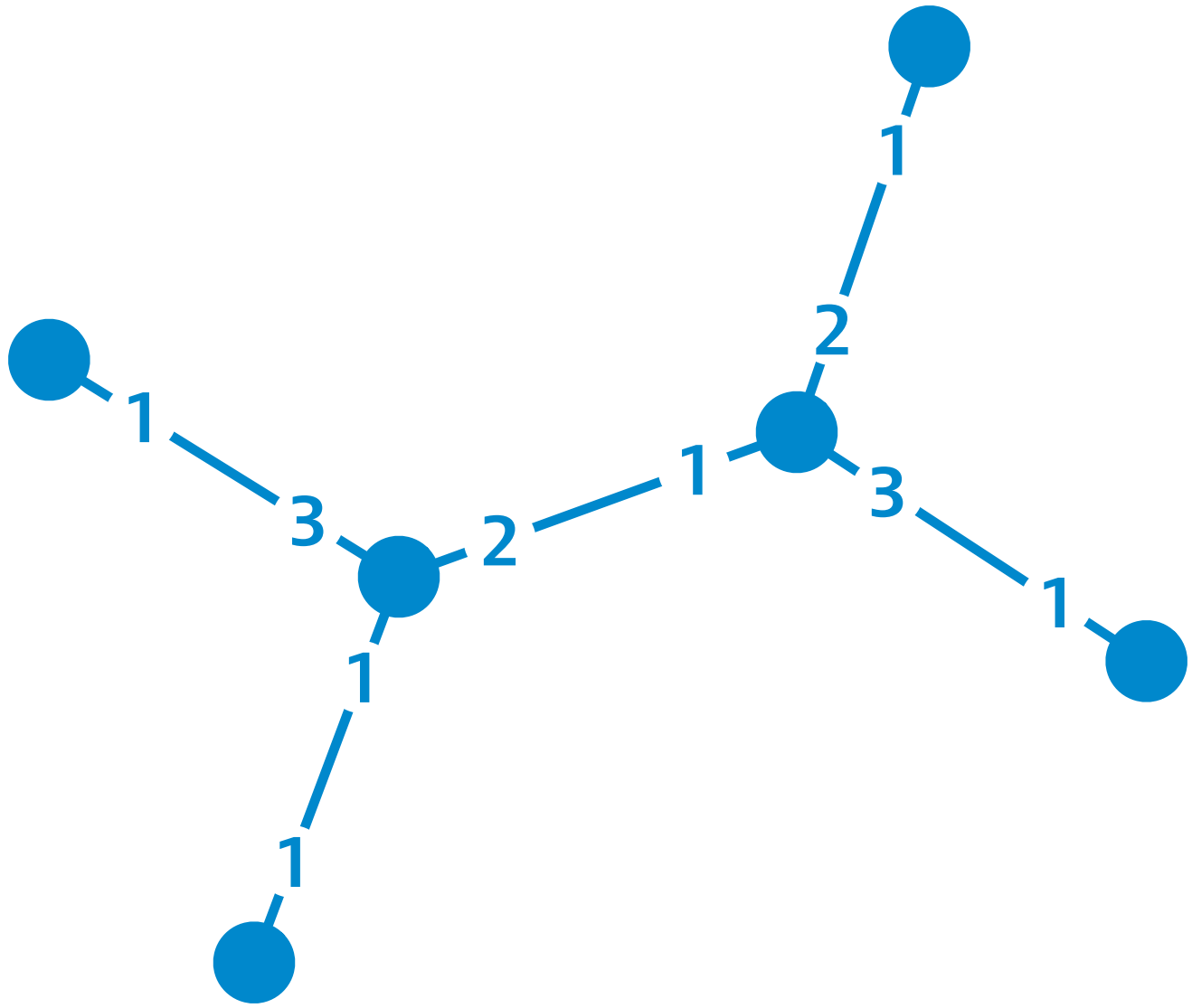
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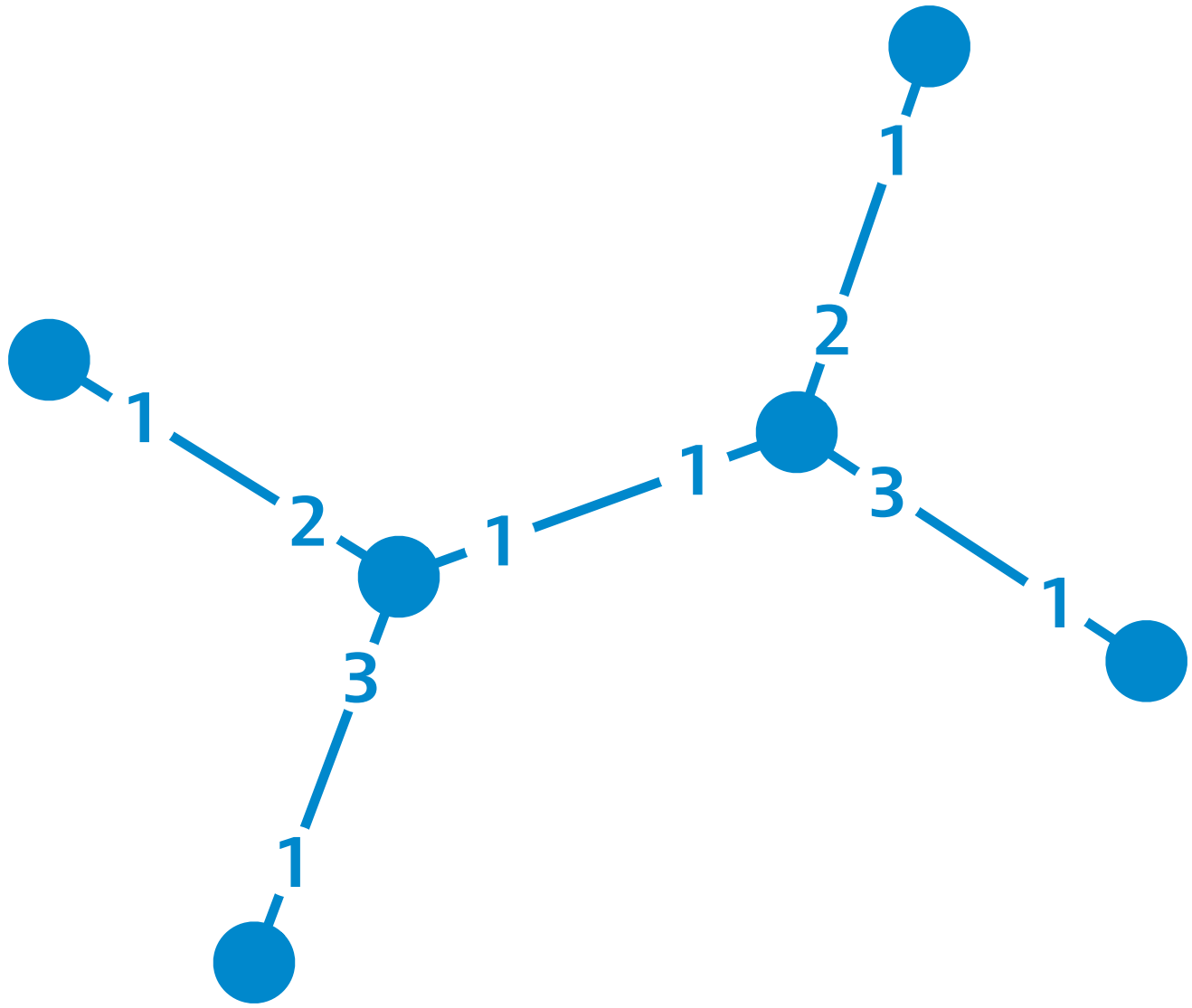
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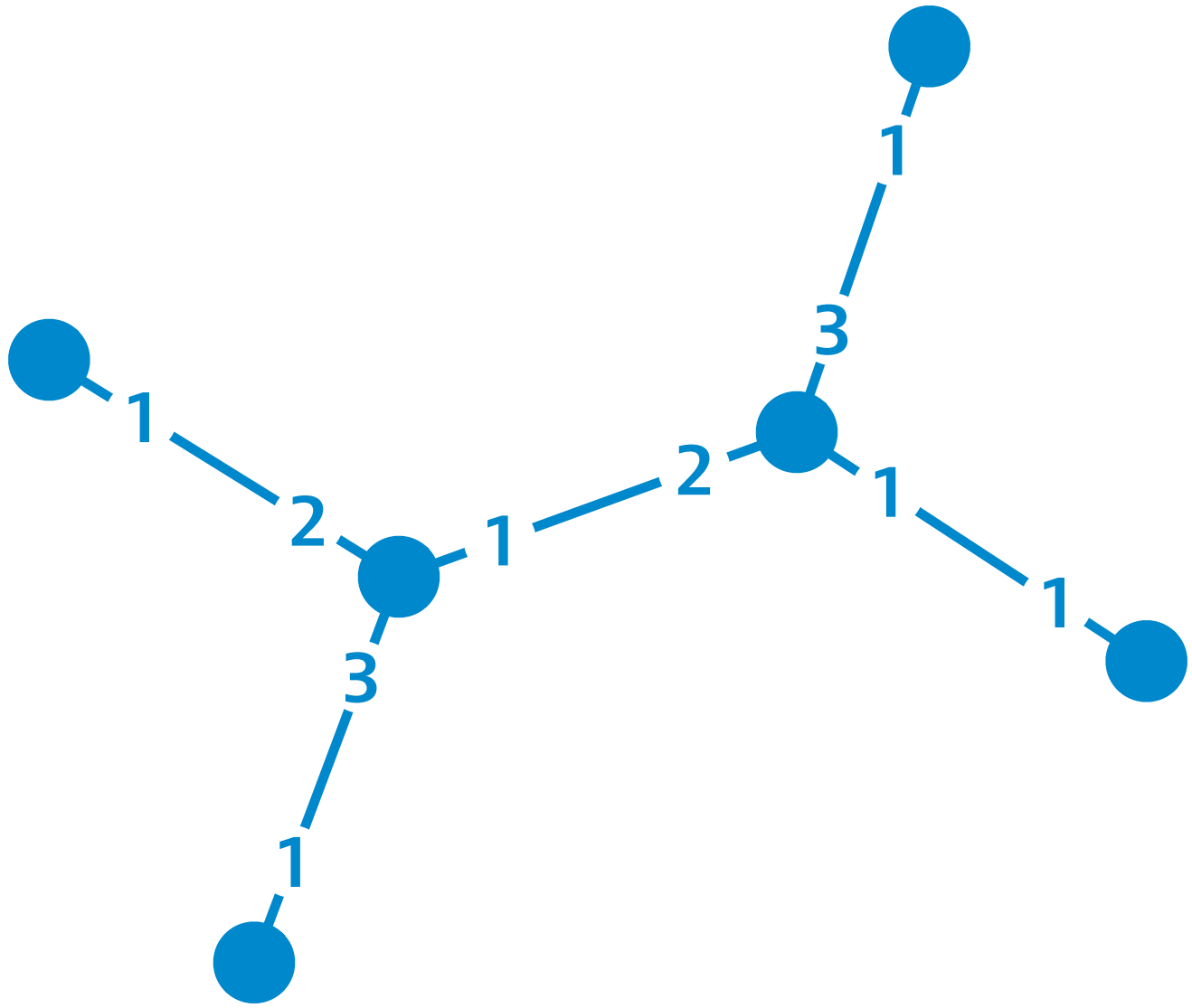
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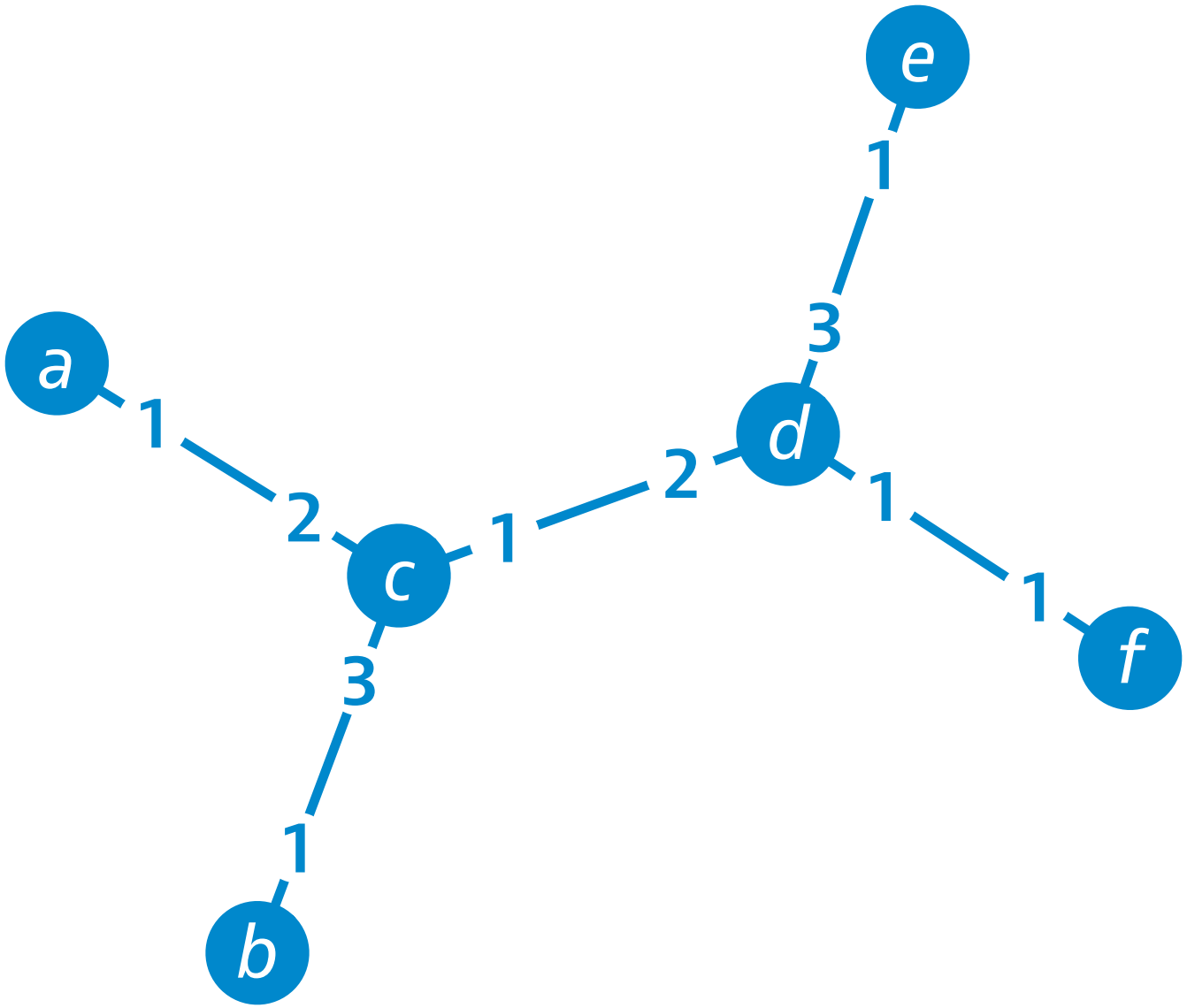
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c
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f
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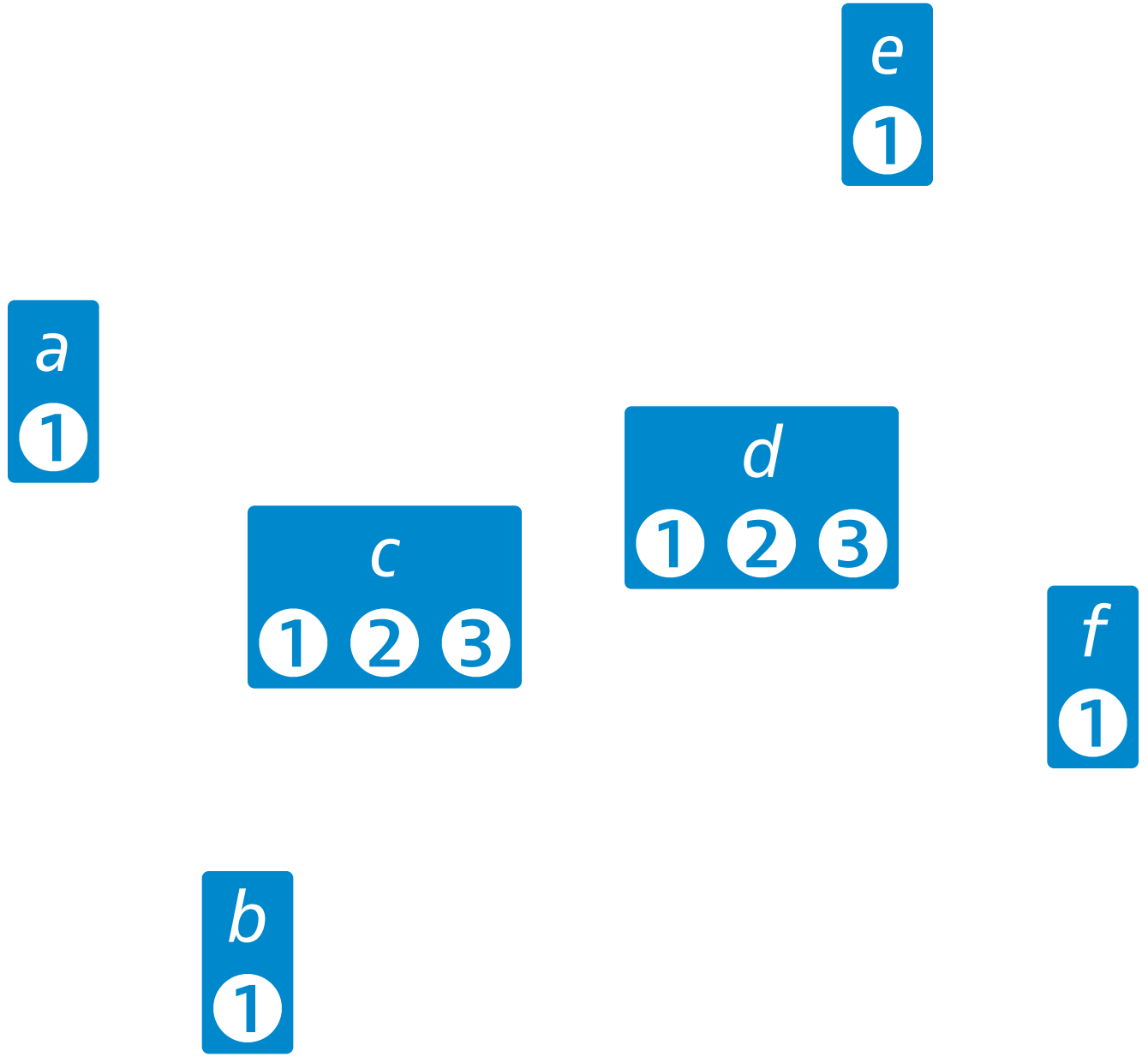
1
b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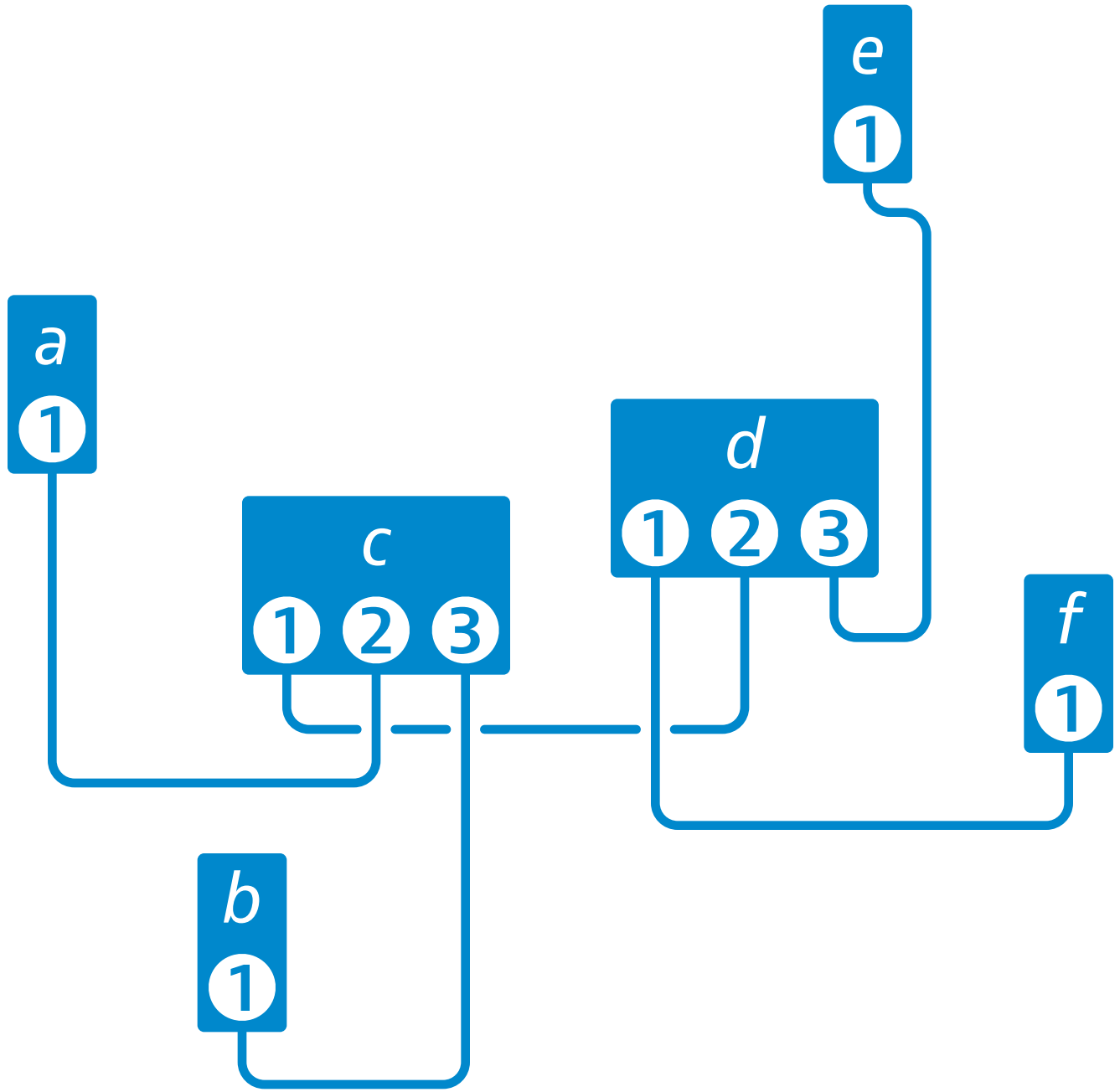
e
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a
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d
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c
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2
3
f
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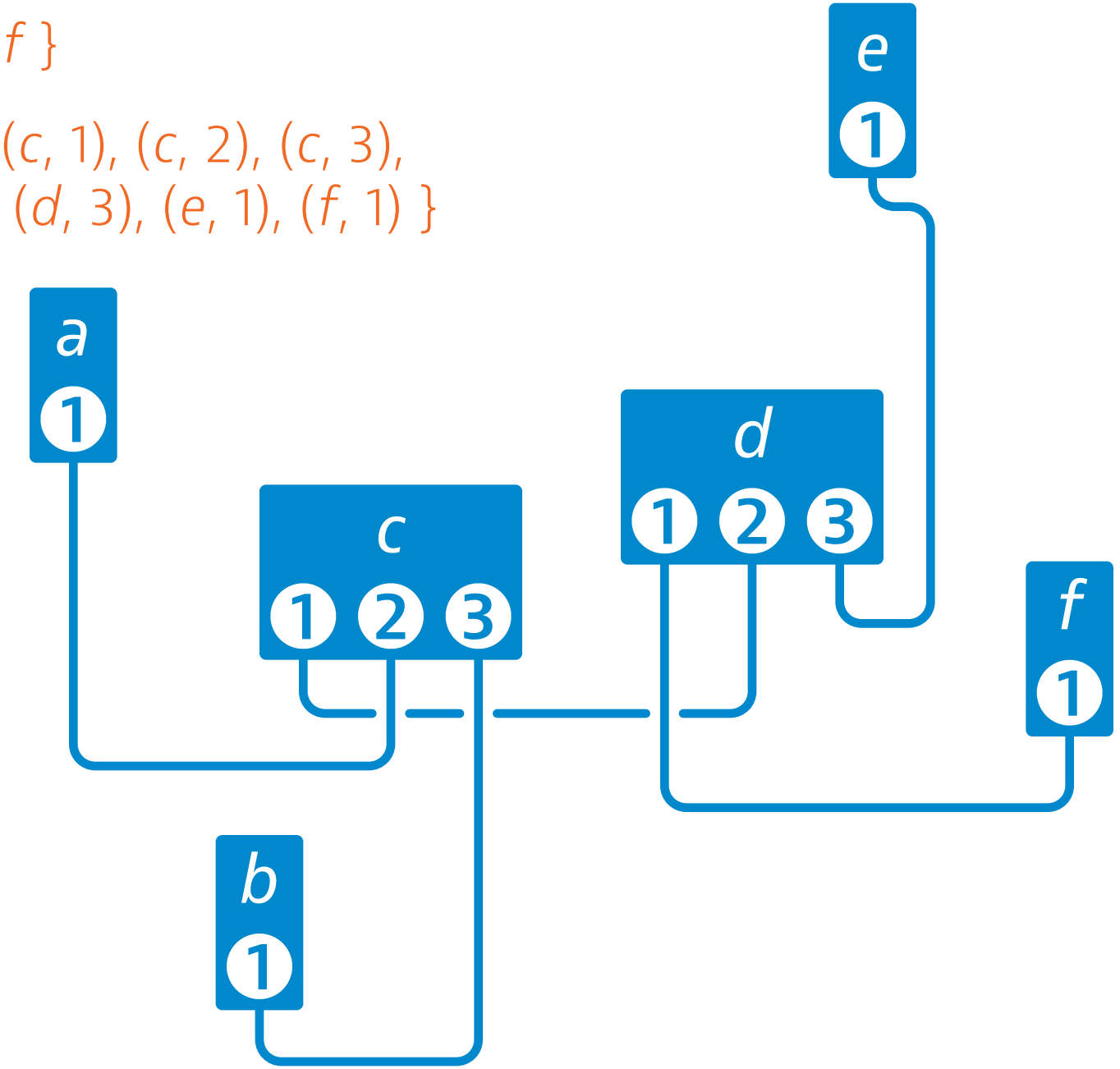
b
1

$V = \{ a, b, c, d, e, f \}$

$P = \{ (a, 1), (b, 1), (c, 1), (c, 2), (c, 3),$
$(d, 1), (d, 2), (d, 3), (e, 1), (f, 1) \}$

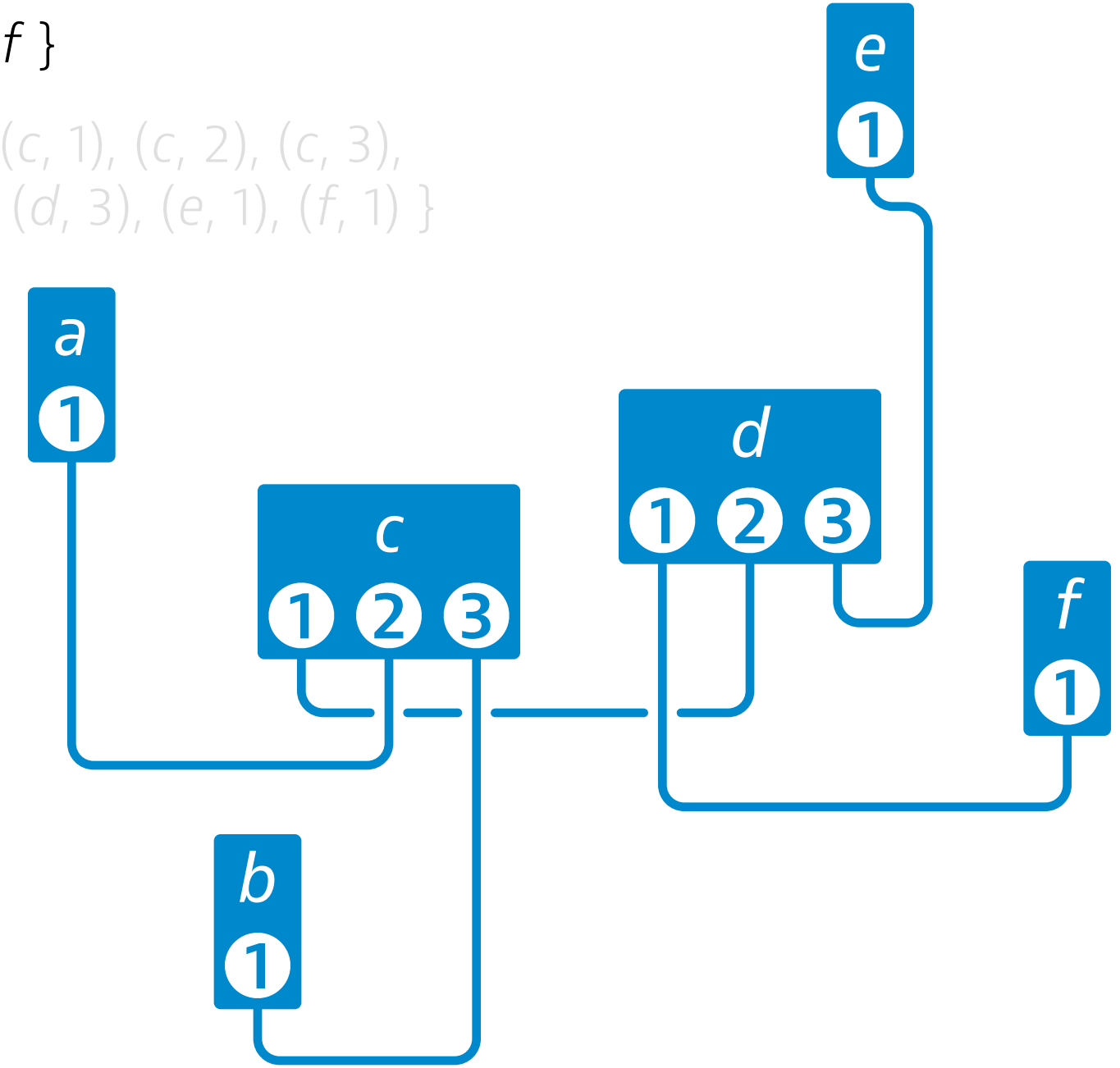
$p(a, 1) = (c, 2)$
$p(b, 1) = (c, 3)$
$p(c, 1) = (d, 2)$
$p(c, 2) = (a, 1)$
$p(c, 3) = (b, 1)$
$p(d, 1) = (f, 1)$
$p(d, 2) = (c, 1)$
$p(d, 3) = (e, 1)$
$p(e, 1) = (d, 3)$
$p(f, 1) = (d, 1)$



$V = \{ a, b, c, d, e, f \}$

$P = \{ (a, 1), (b, 1), (c, 1), (c, 2), (c, 3),$
$(d, 1), (d, 2), (d, 3), (e, 1), (f, 1) \}$

$p(a, 1) = (c, 2)$
$p(b, 1) = (c, 3)$
$p(c, 1) = (d, 2)$
$p(c, 2) = (a, 1)$
$p(c, 3) = (b, 1)$
$p(d, 1) = (f, 1)$
$p(d, 2) = (c, 1)$
$p(d, 3) = (e, 1)$
$p(e, 1) = (d, 3)$
$p(f, 1) = (d, 1)$



$V = \{ a, b, c, d, e, f \}$

$P = \{ (a, 1), (b, 1), (c, 1), (c, 2), (c, 3),$
$\{ (d, 1), (d, 2), (d, 3), (e, 1), (f, 1) \}$

$p(a, 1) = (c, 2)$
$p(b, 1) = (c, 3)$
$p(c, 1) = (d, 2)$
$p(c, 2) = (a, 1)$
$p(c, 3) = (b, 1)$
$p(d, 1) = (f, 1)$
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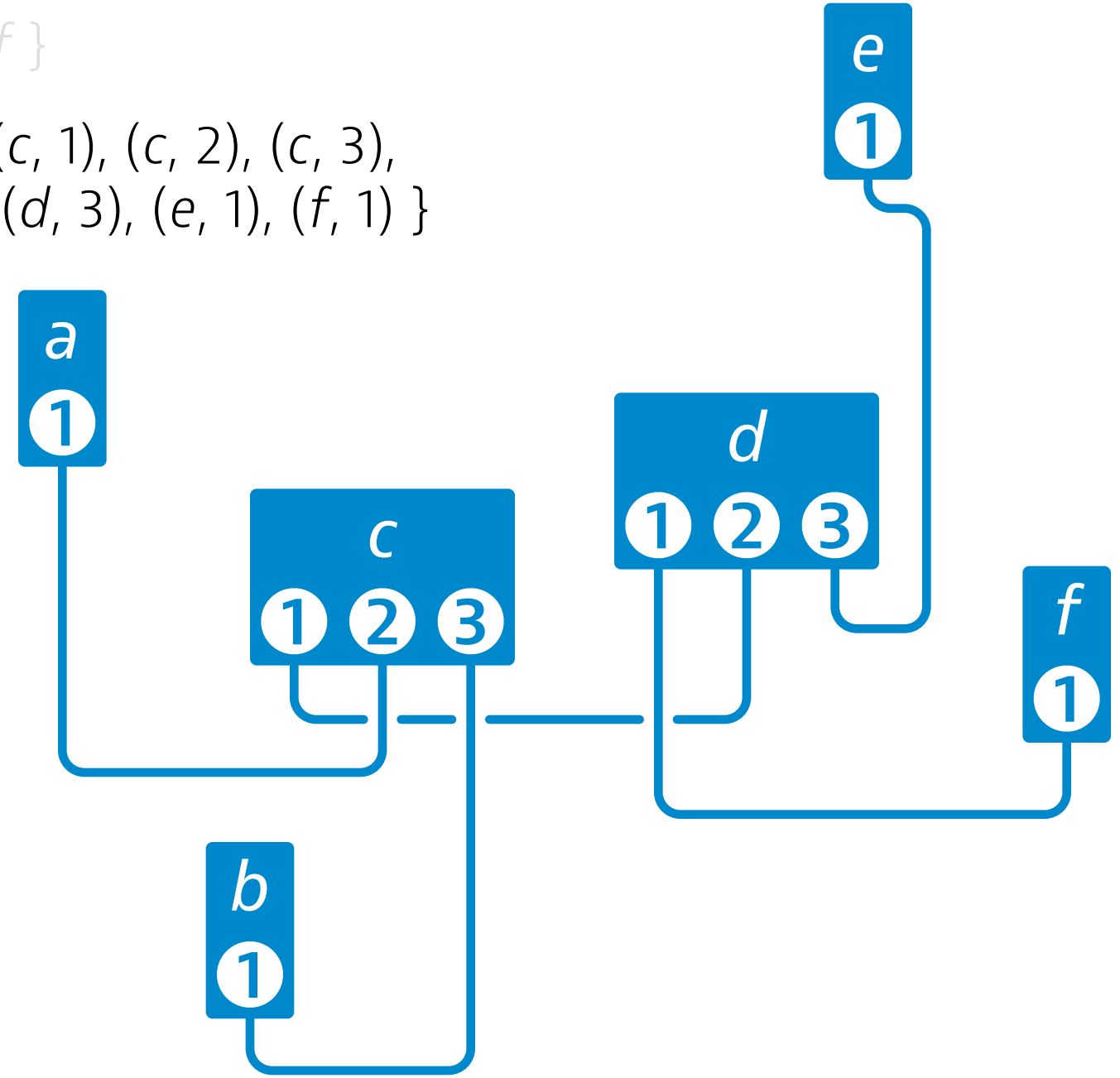

$V = \{ a, b, c, d, e, f \}$

$P = \{ (a, 1), (b, 1), (c, 1), (c, 2), (c, 3),$
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$p(a, 1) = (c, 2)$
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$p(c, 1) = (d, 2)$
$p(c, 2) = (a, 1)$
$p(c, 3) = (b, 1)$
$p(d, 1) = (f, 1)$
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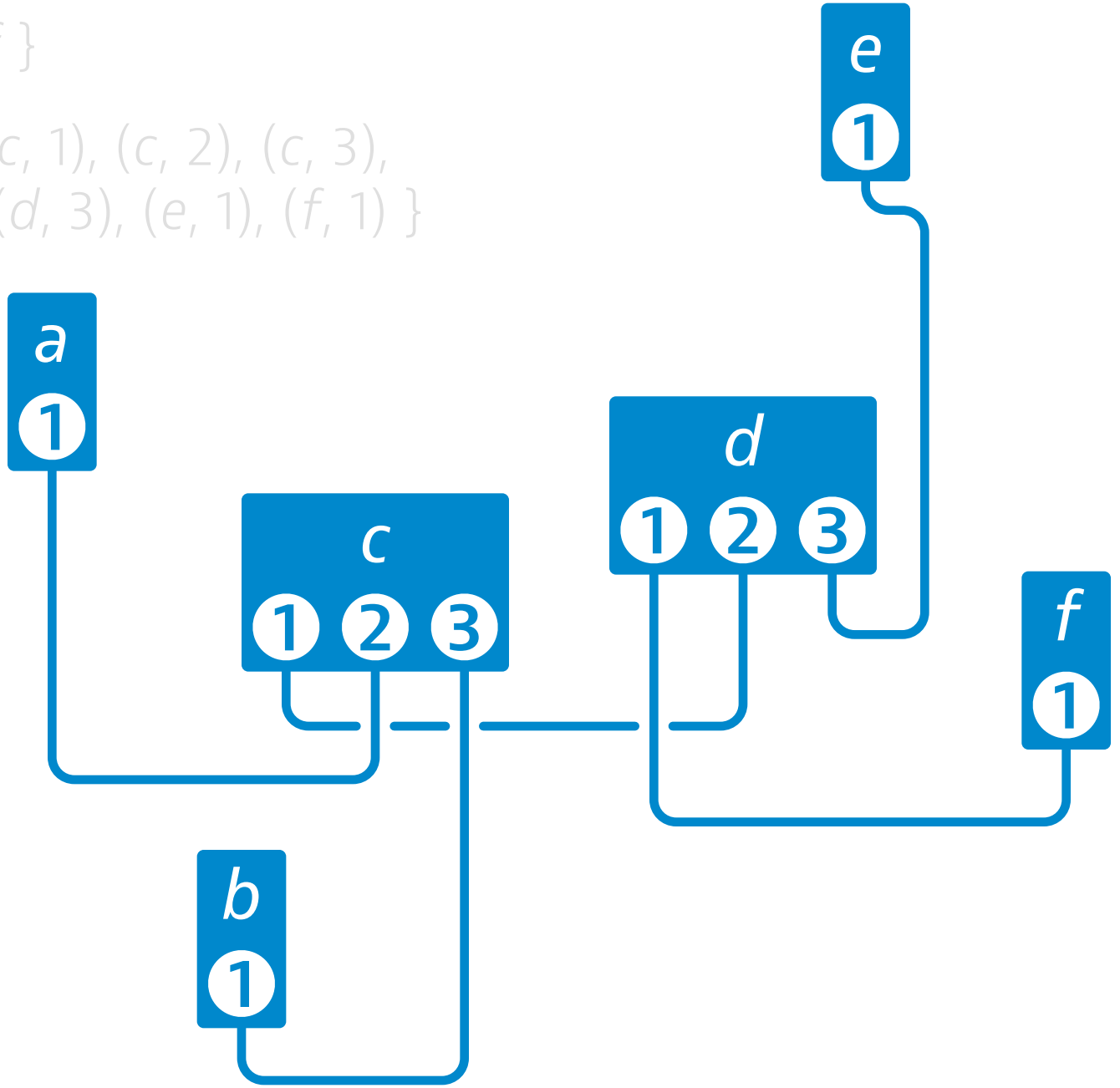
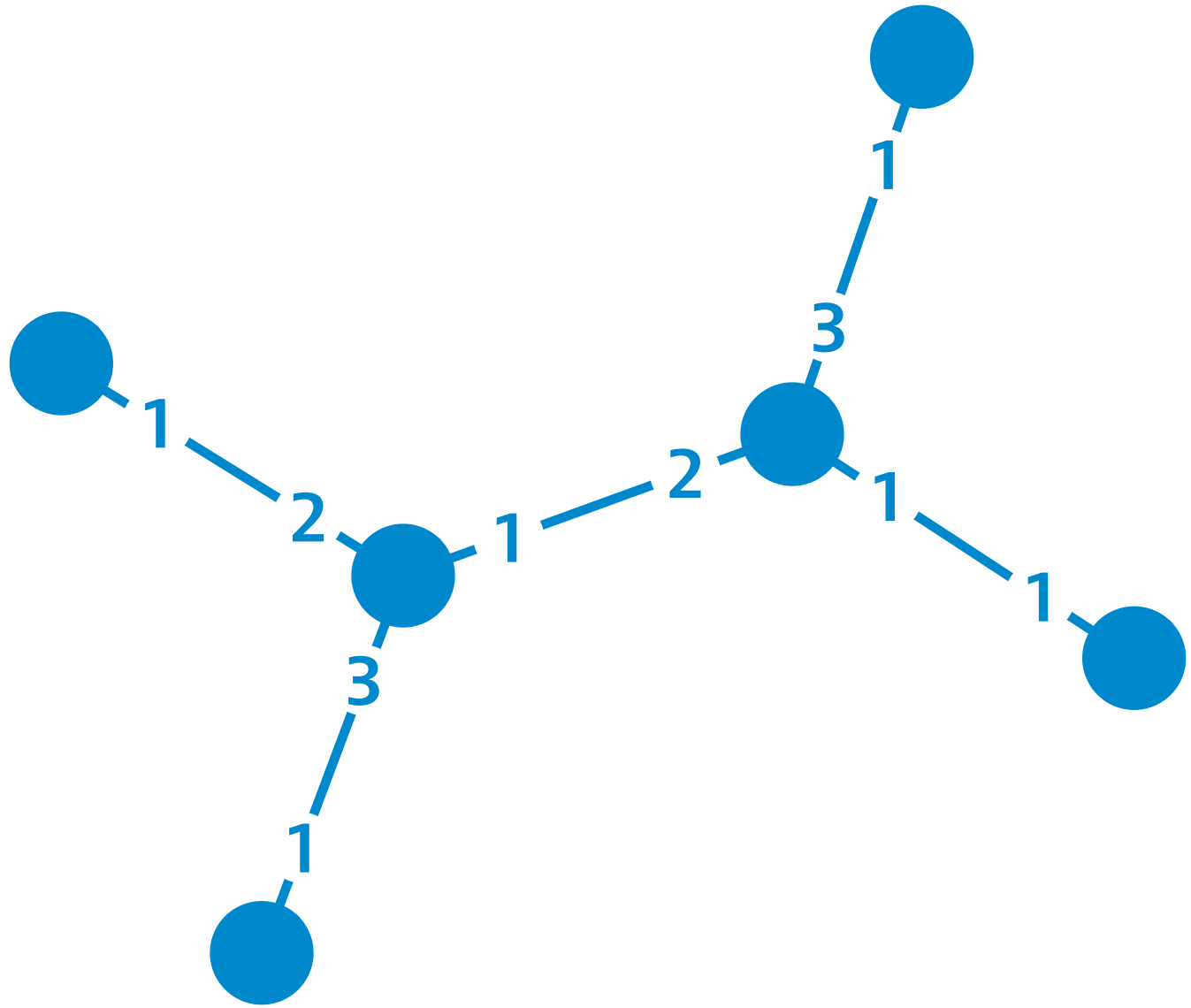


Distributed algorithms in PN model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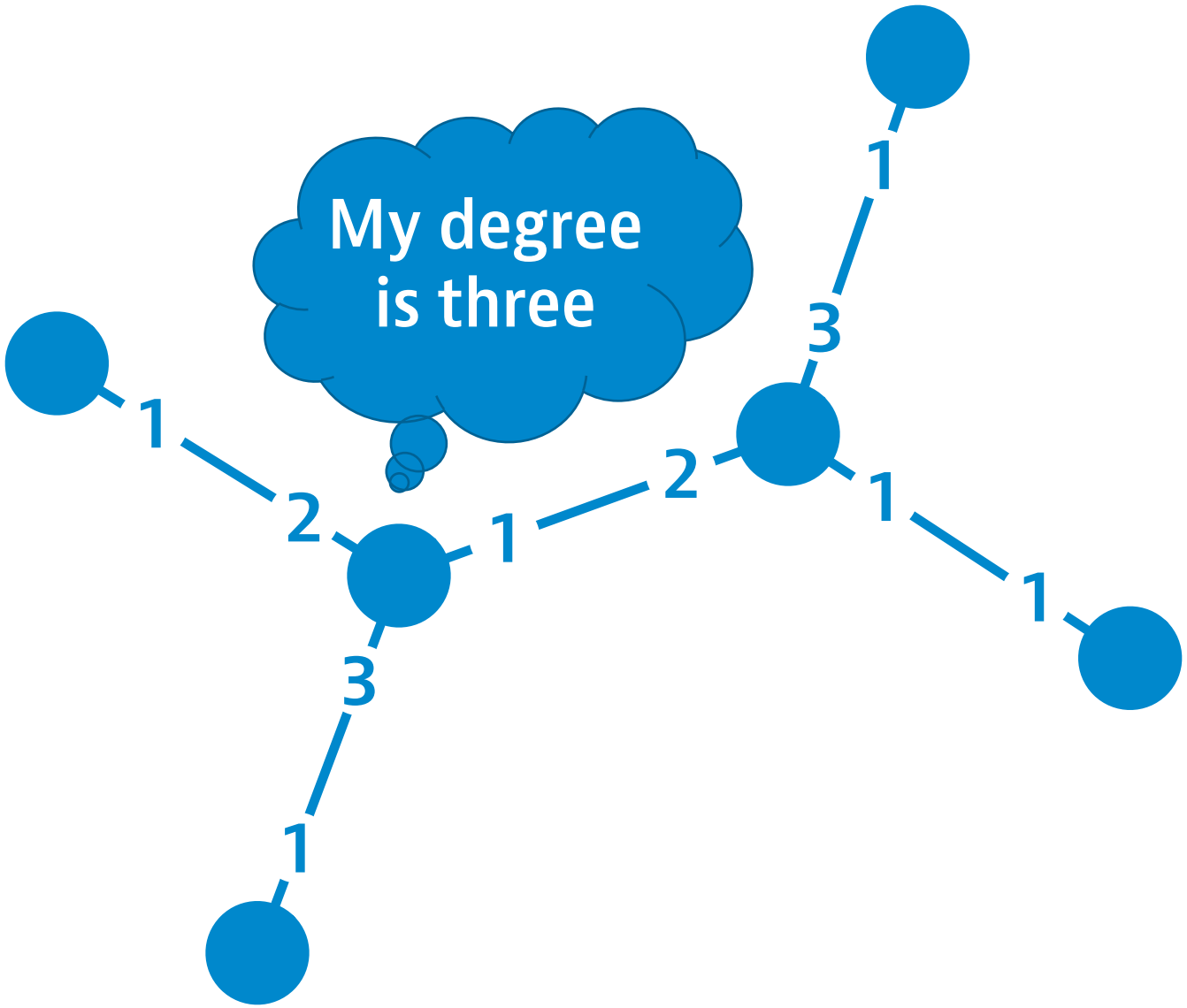
My degree
is three
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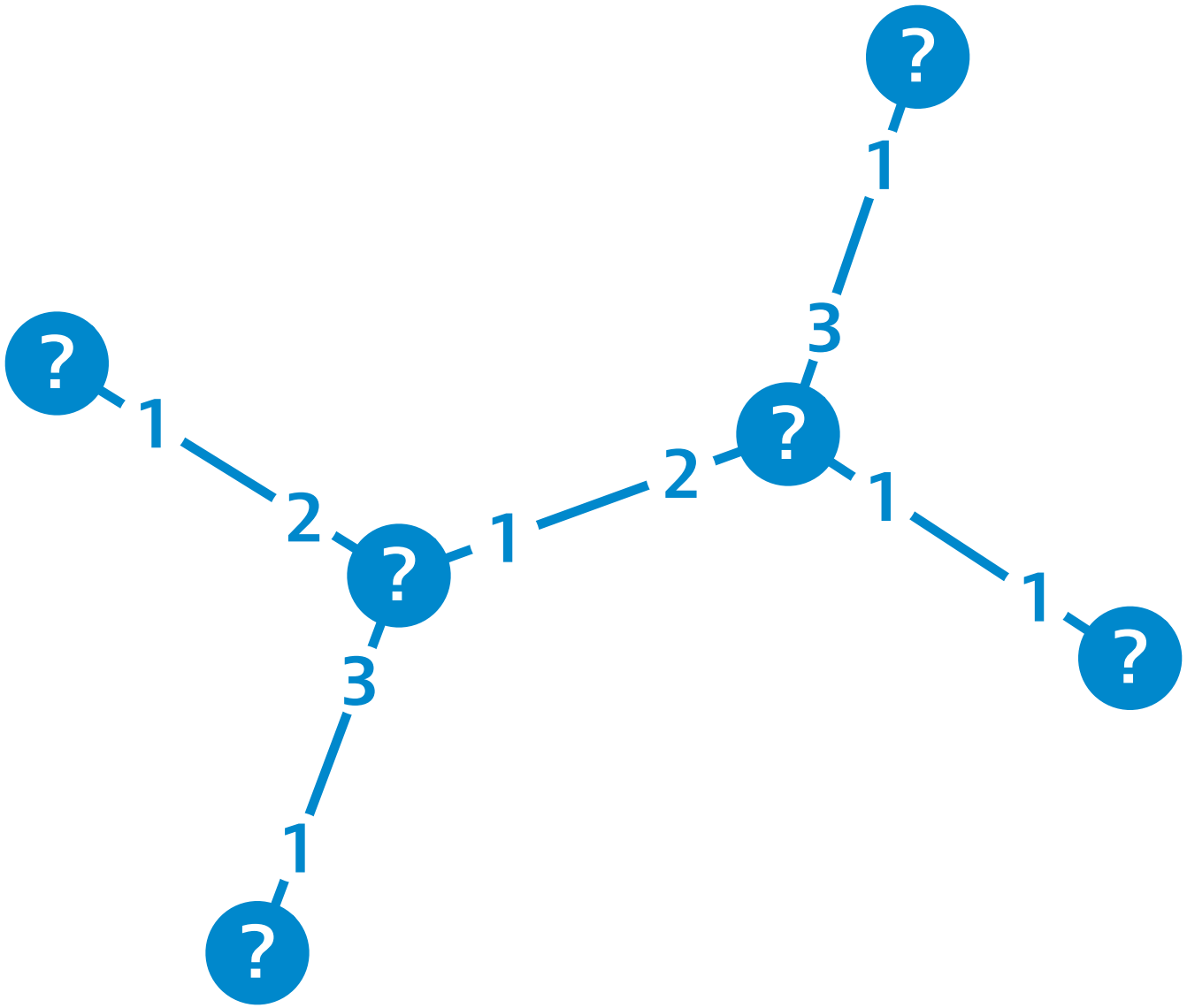
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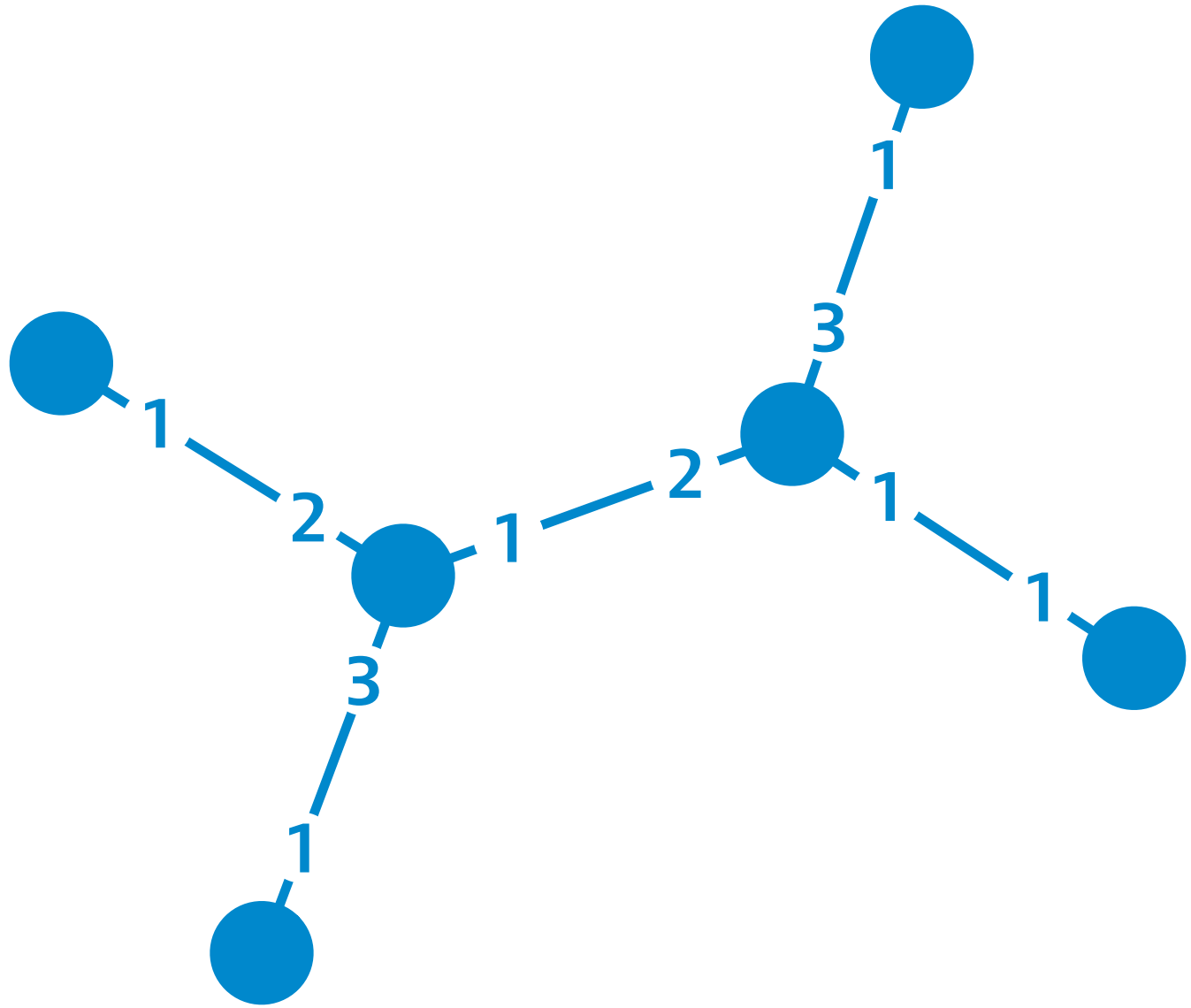
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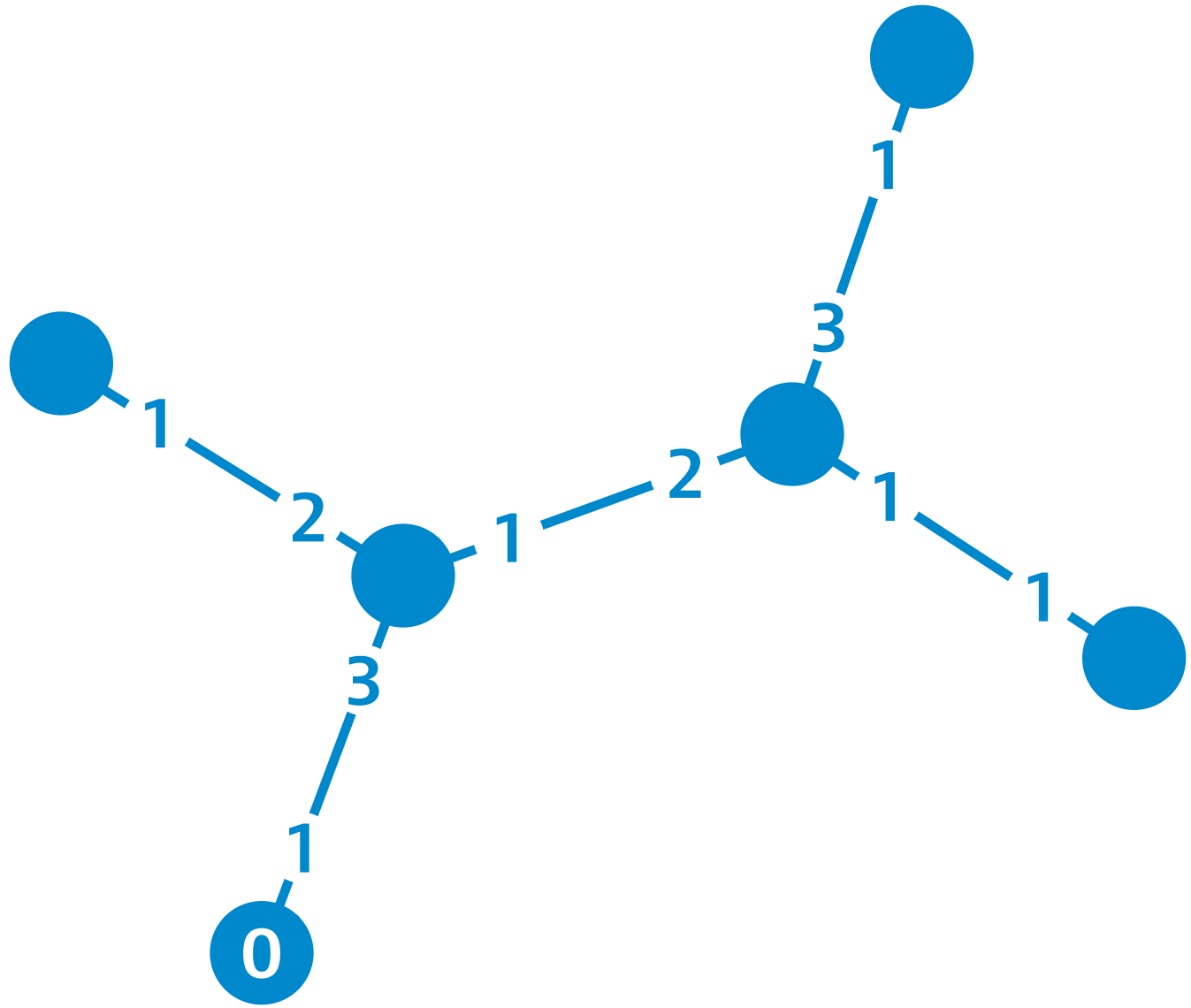
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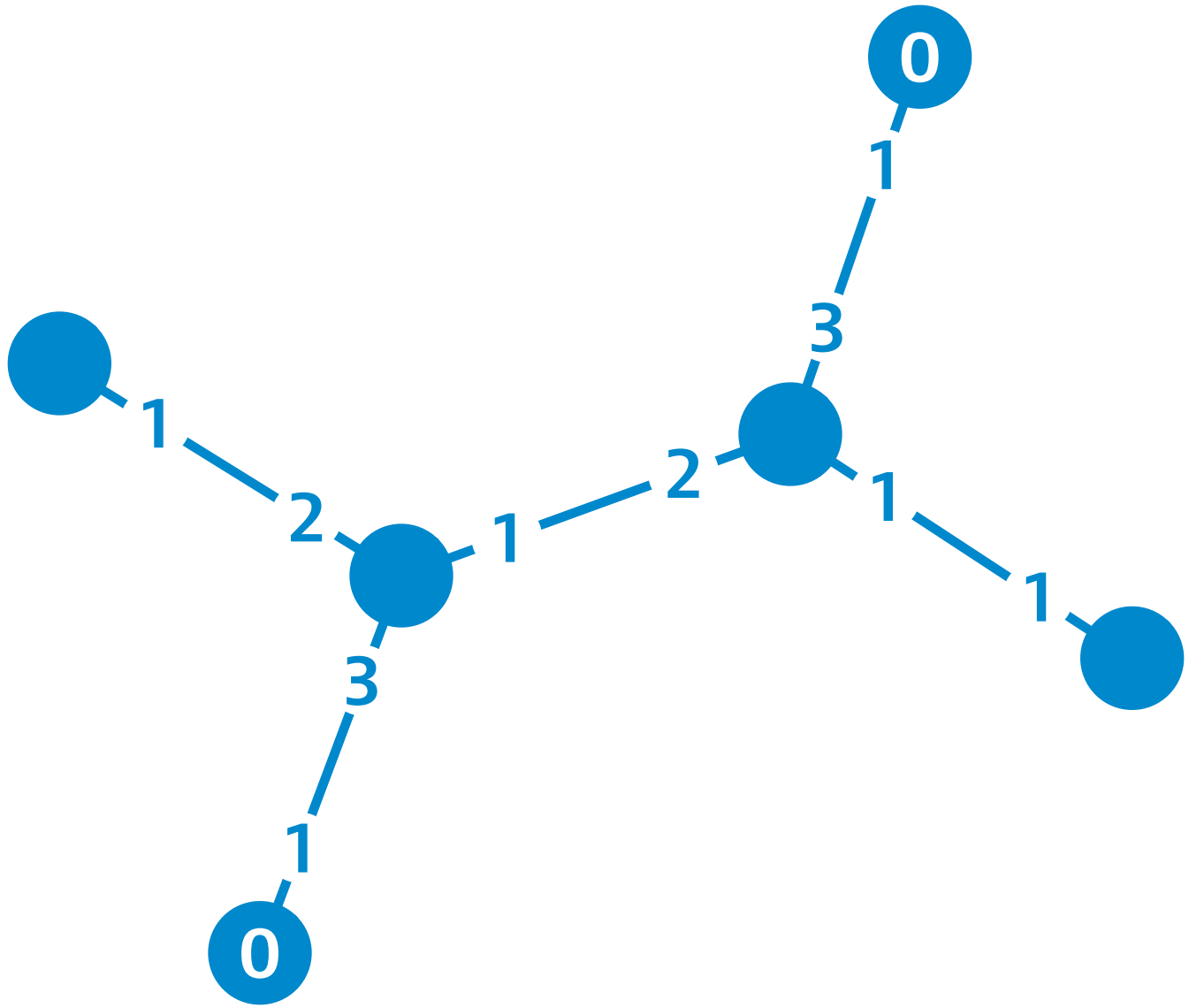
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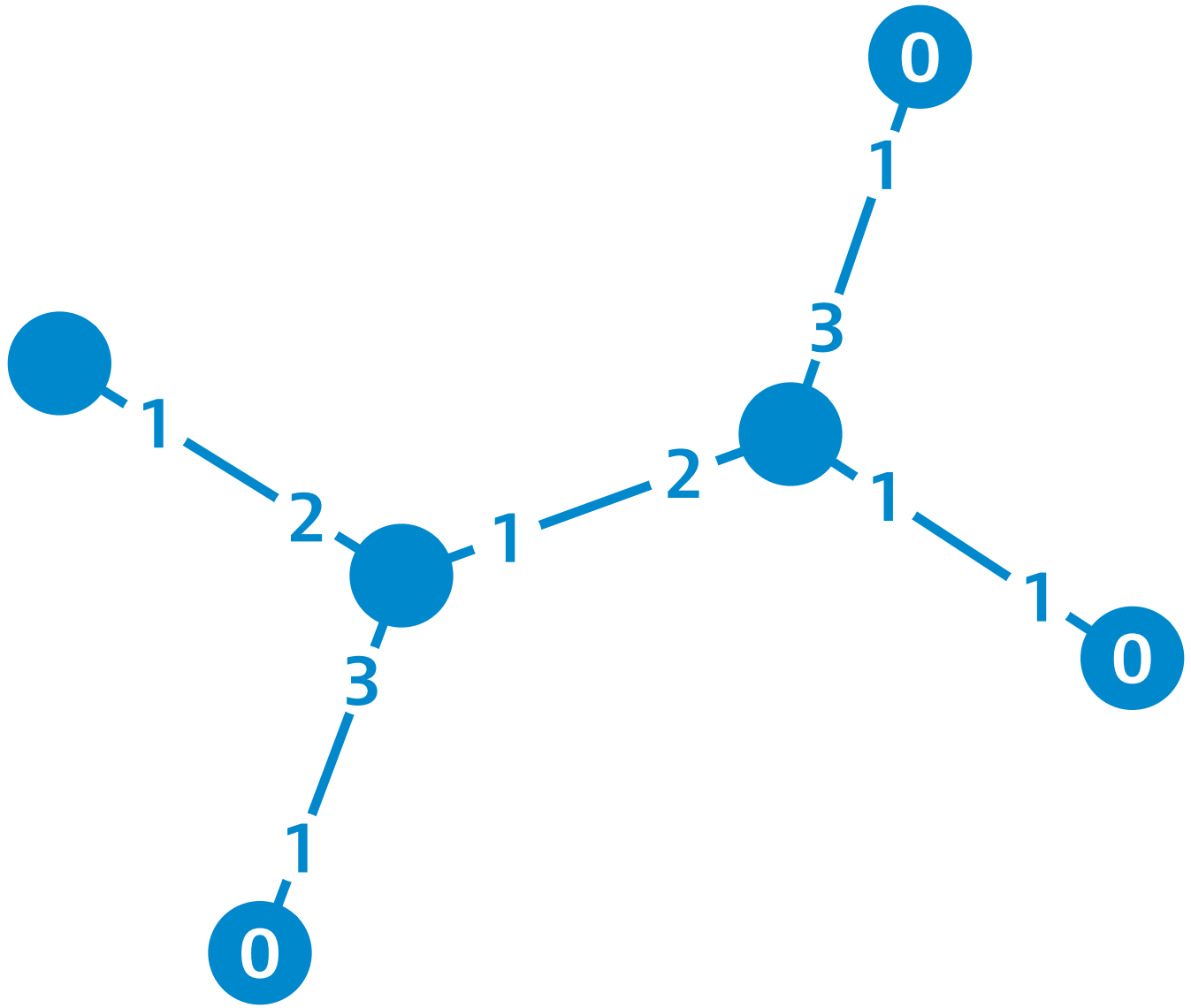
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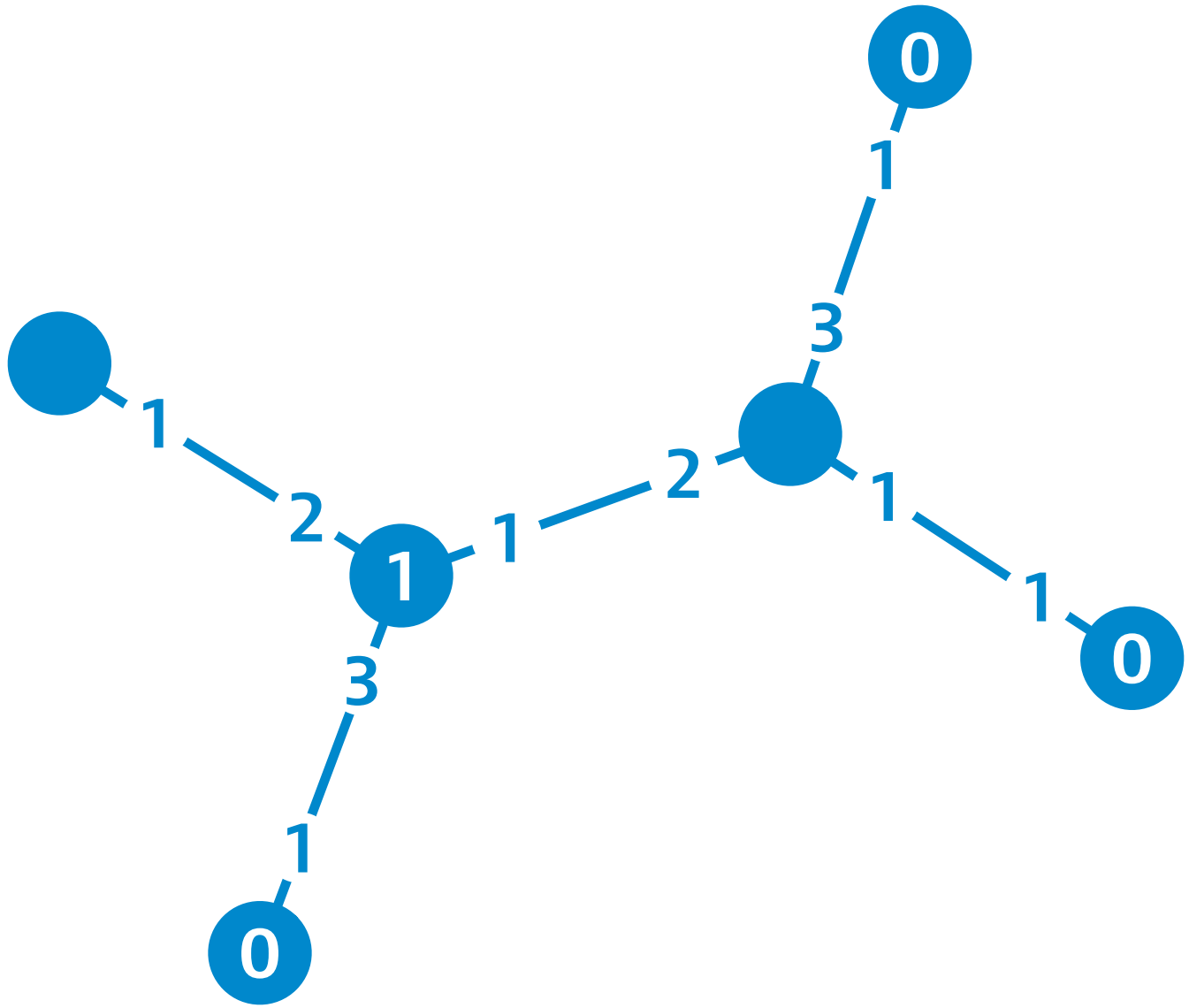
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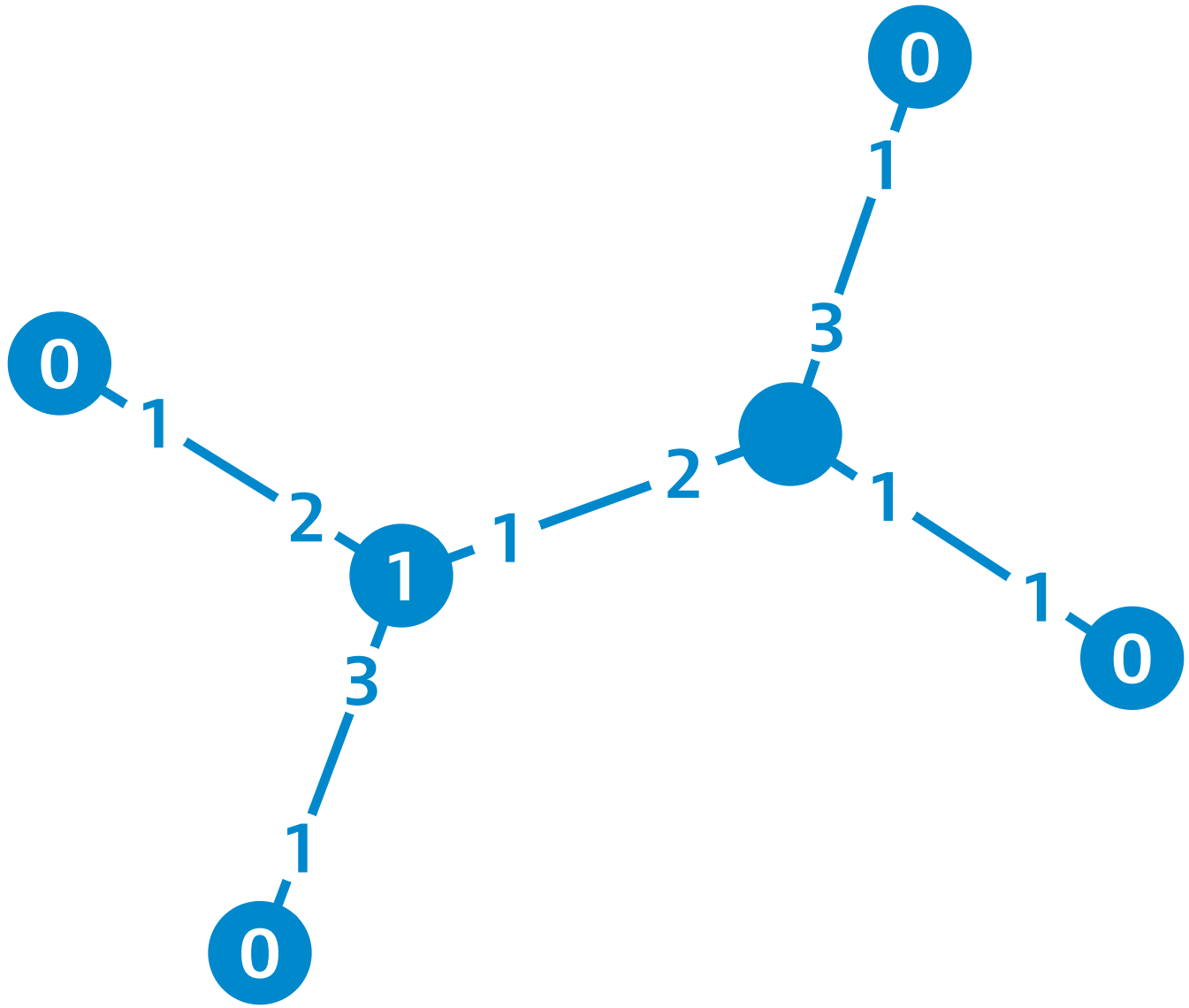
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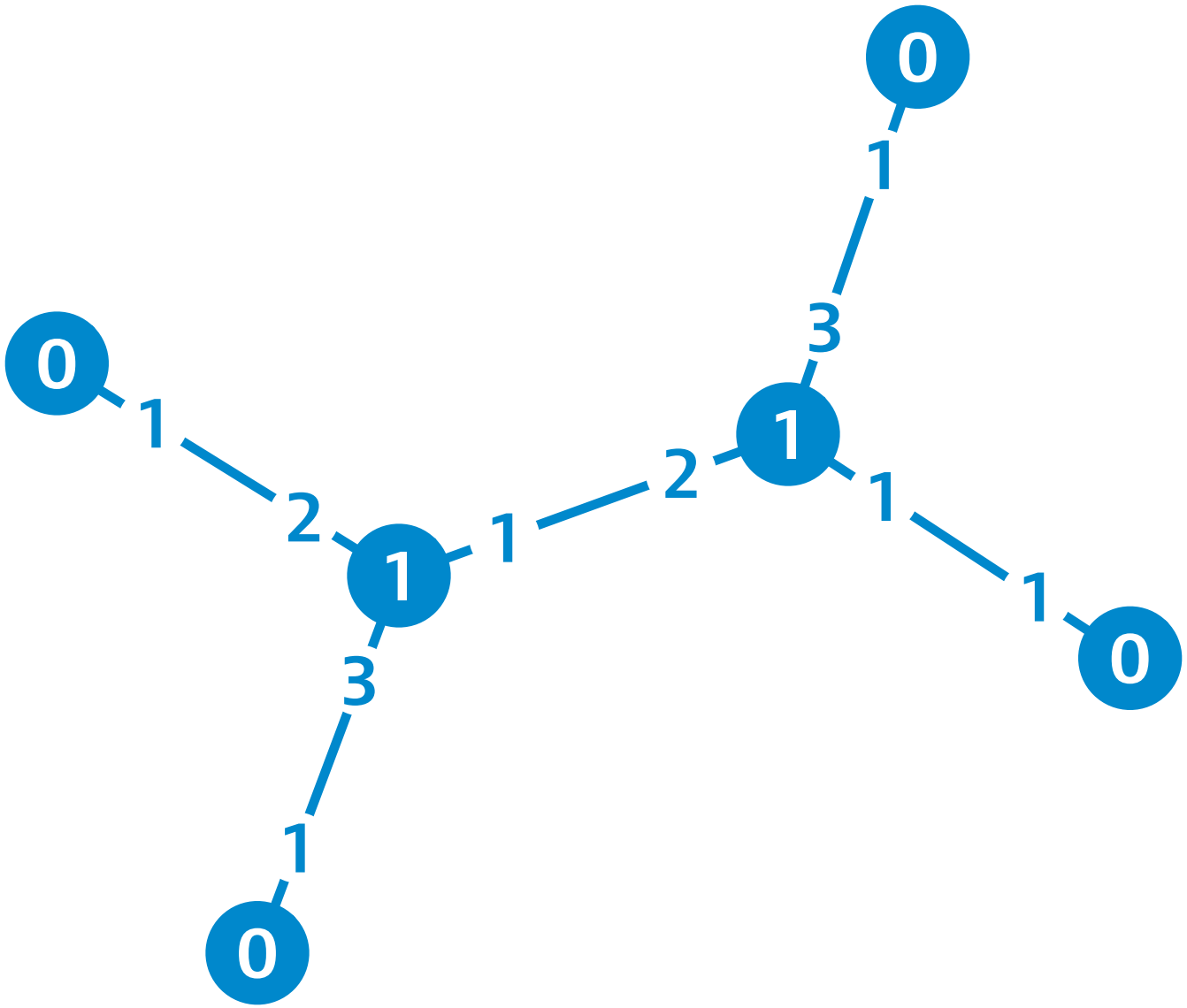
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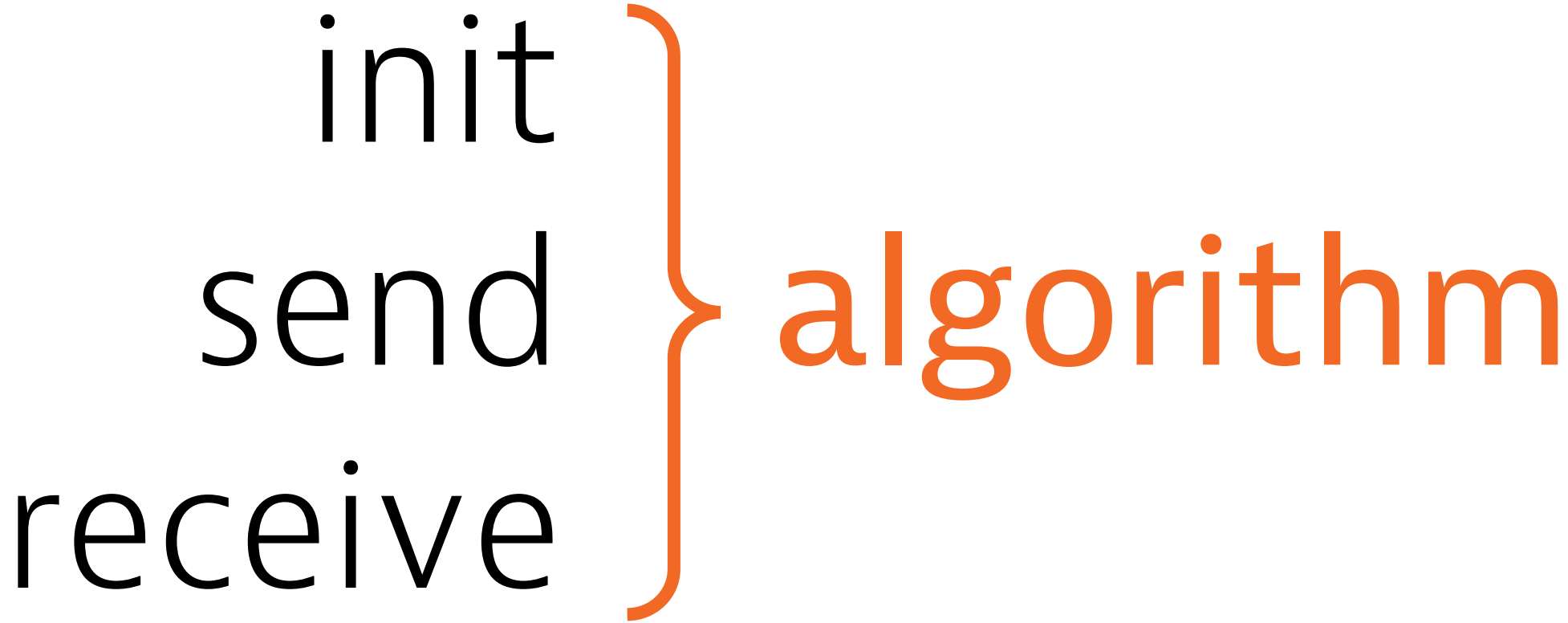
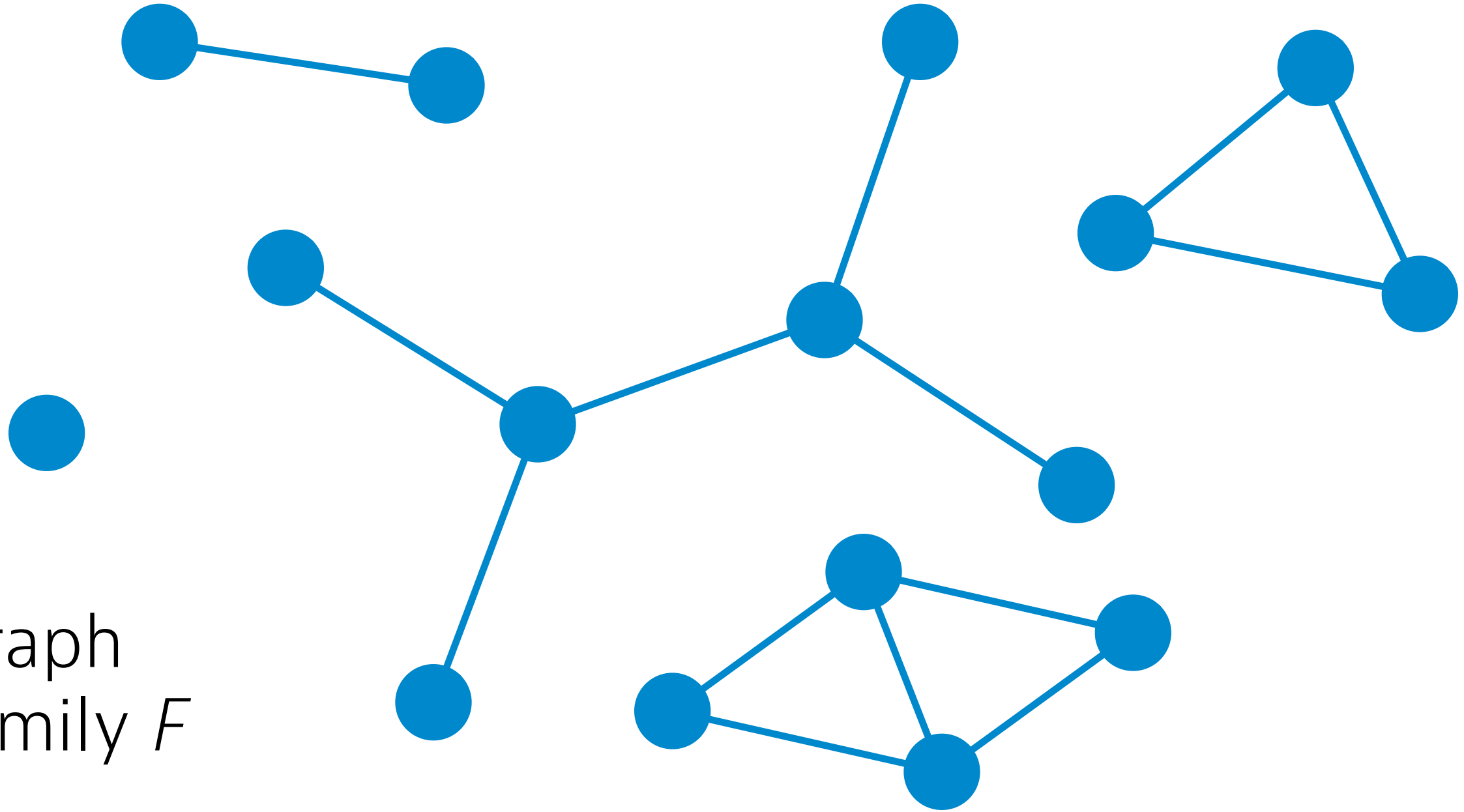

init
send
receive
algorithm

Port-numbered network
$N = (V, P, p)$

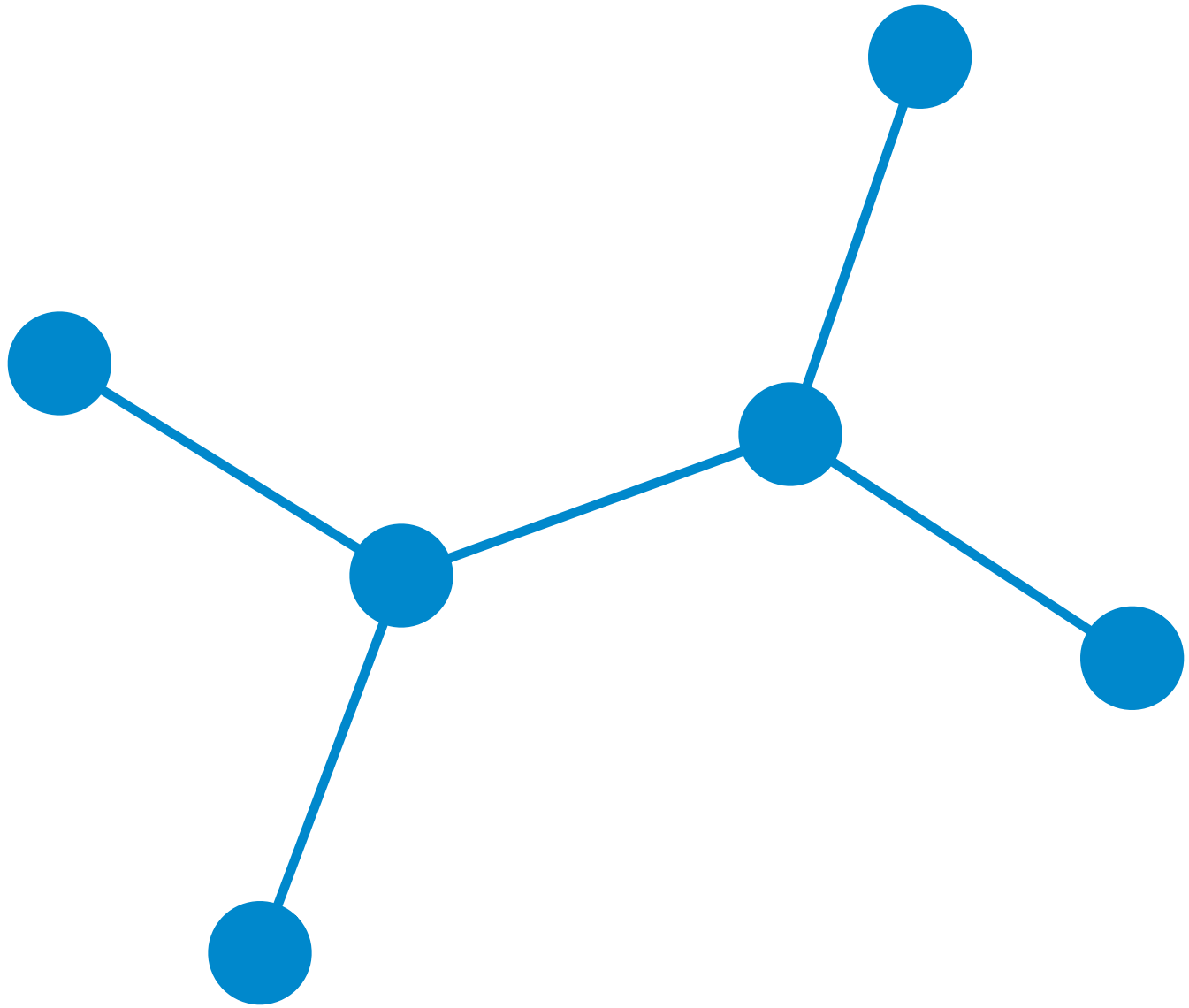
Distributed algorithm
A = (init, send, receive)

Output of algorithm A in network N

"Algorithm *A* solves problem *X* in graph family *F*"

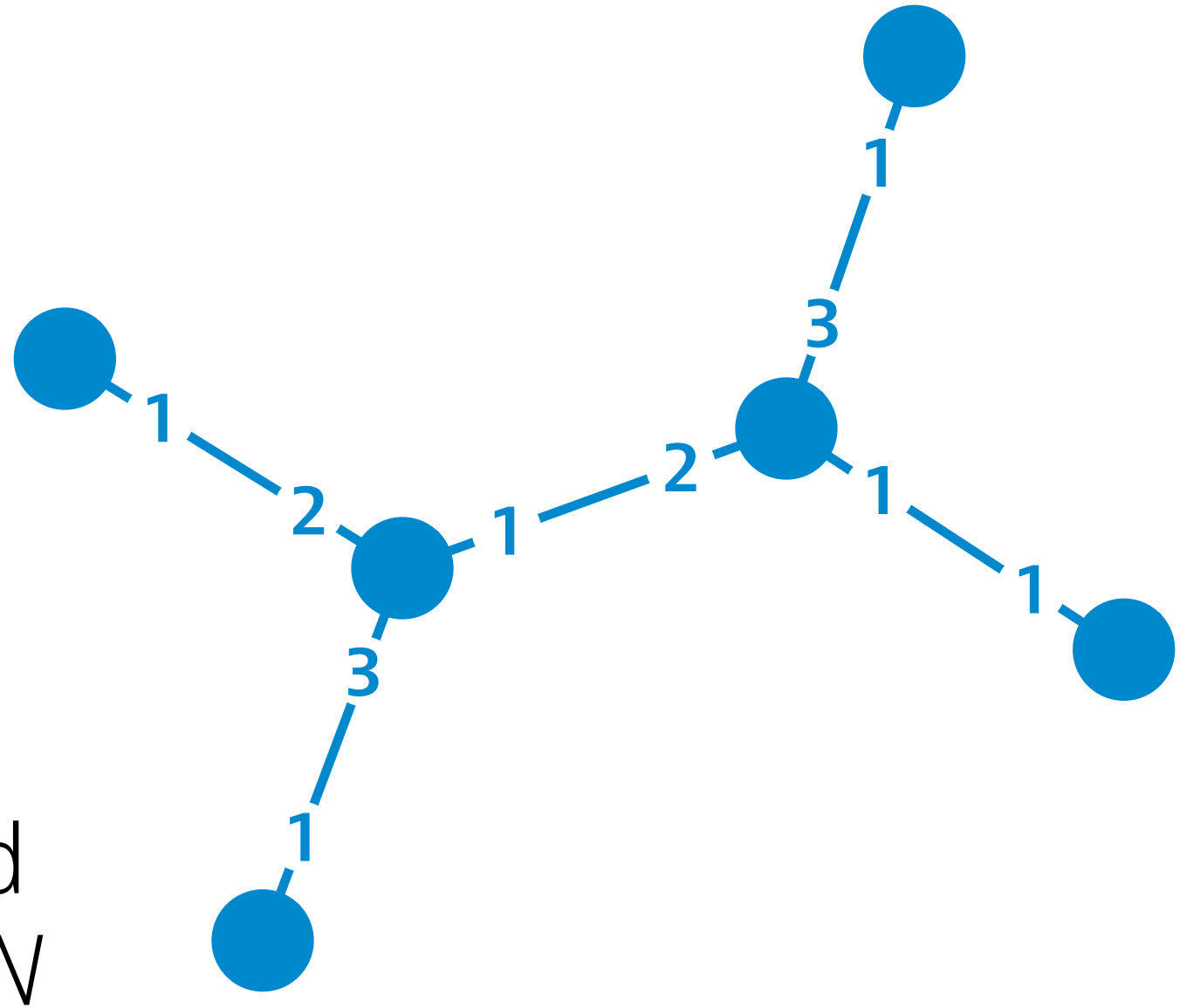


Graph
family *F*

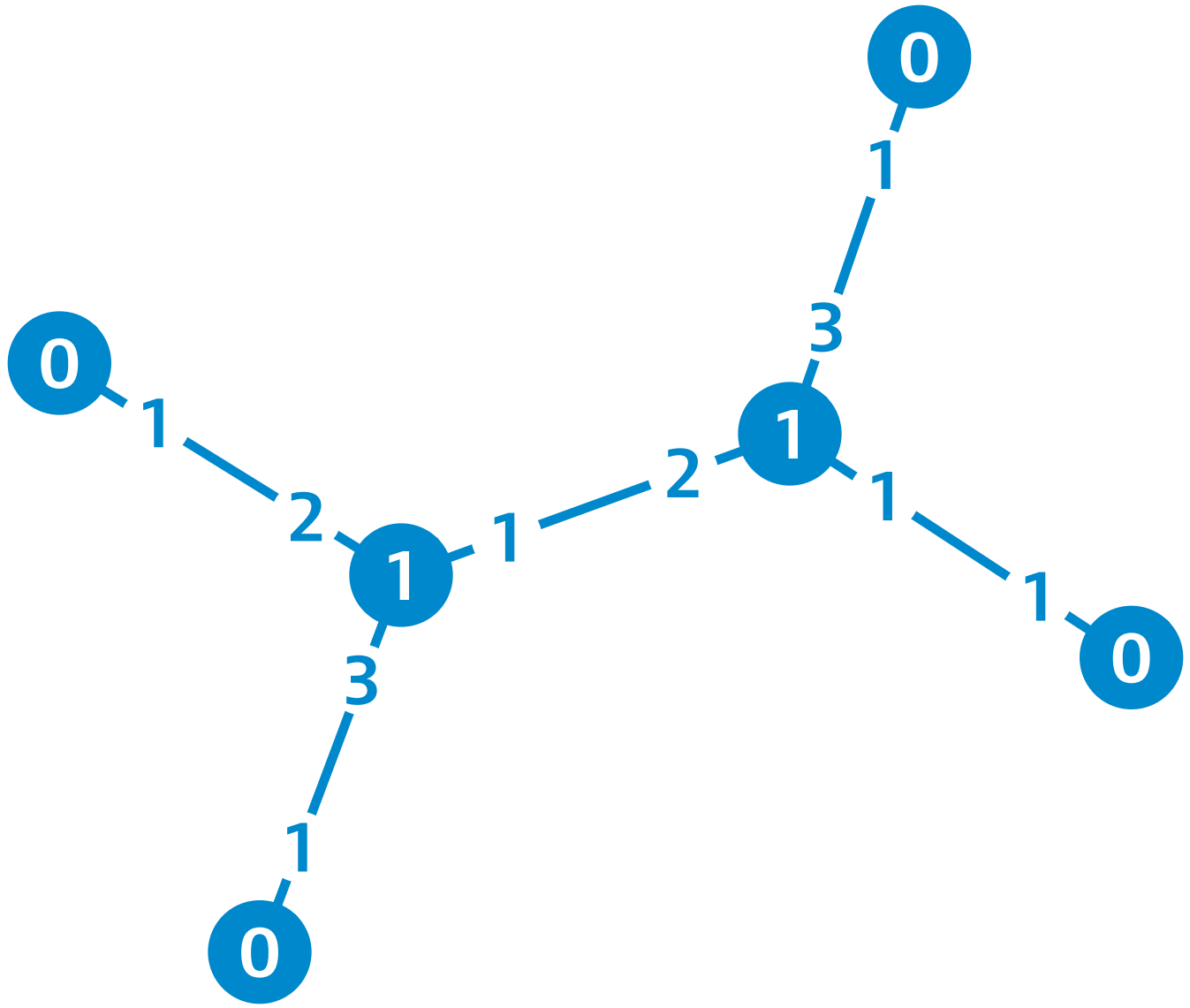


Graph *G*

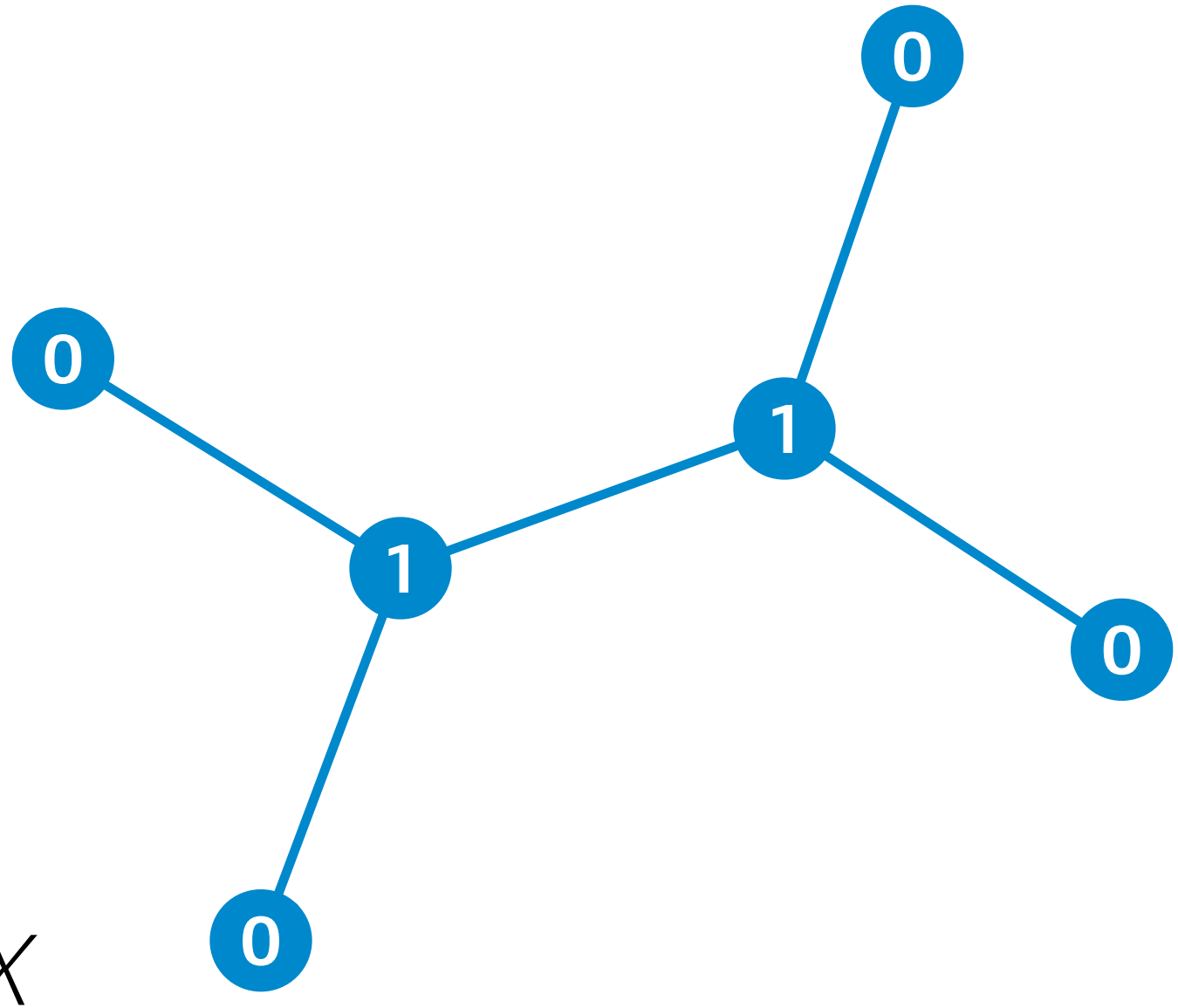
Port-numbered network N



Output



Solution to graph problem *X*



Time = number of communication rounds

Everything is deterministic