The Liquid Democracy Journal

on electronic participation, collective moderation, and voting systems

Issue 3

Berlin, 2015-01-23

The Liquid Democracy Journal is dedicated to the idea of Liquid Democracy, which is a democratic principle that uses transitive delegations to unite the best of direct and representative democracy.

But this journal is not just limited to Liquid Democracy; it also covers those topics coming up when implementing it: **electronic particatipation, collective moderation, and voting systems.**

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Issue 3, Berlin 2015-01-23 (electronic version 2015-03-28)

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Johannisstraße 12
10117 Berlin
Germany

http://www.interaktive-demokratie.org/

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ISSN-L: 2198–9532
ISSN print version: 2198–9532
ISSN electronic version: 2199–1758

Editorial

by the Editors, Berlin, January 23, 2015

In the past, we emphasized the important role of transitive delegations for the idea of Liquid Democracy: stripping transitivity from Liquid Democracy would give advantage to people according to their technical abilities and/or social integration, while a fully-transitive delegation model allows an equal treatment of all voters regardless of whether they are directly participating in a vote or delegating the decision to experts. [PLF, subsection 2.4.2]

Occasionally, we were inquired as to whether it was possible to incorporate the idea of a preferential delegation model into LiquidFeedback. Due to the previously stated reasons (equal treatment of all voters), the transitivity would need to be combined with (and not replaced by) a preference model where each voter can provide a list of delegates for a single issue instead of selecting one particular person as delegate.

At first, our main reason to not incorporate such a feature was the complexity of combining transitivity and precedence (e.g. the impossibility to use simple delegation chains for graphic representation). But recently we discovered that extending LiquidFeedback by adding a preferential delegation model would always break certain (mathematical) properties of the system. The two articles of this issue #3 will deal with the proof and the consequences for online decision-making systems.

The Editors

[PLF] Behrens, Kistner, Nitsche, Swierczek: "The Principles of LiquidFeedback". ISBN 978-3-00-044795-2. Published January 2014 by Interaktive Demokratie e. V., available at http://principles.liquidfeedback.org/

Read in this Issue:

Preferential Delegation and the Problem of Negative Voting Weight

by Jan Behrens & Björn Swierczek, Berlin, January 23, 2015

In this article, we analyze all systems where each voter may freely choose to vote directly, or to delegate the decision to one or more persons of his or her free choice, or to abstain from voting (i.e. neither voting directly nor delegating to another person).

If two people are chosen as delegates to cast one's vote, then the delegating person must select one person as primary delegate, in which case the other person will be referred to as the secondary delegate. Accordingly, a preference list has to be provided by the voter in case of more than two delegates. If only one person is chosen as delegate, we also refer to that delegate as primary delegate for the remainder of this article.

We further assume that the reader is familiar with the general concept of vote delegation and the dualism of transferring voting weight and copying your delegate's vote. [PLF, p.23]

We expect such a system to fulfill at least the following 7 properties:

Property 1 ("Precedence")

If a person A does not vote directly but has one delegate B, or two delegates B and C, where B is the primary and C is the secondary delegate, and none of A's delegates is either delegating to A, to each other, or to any other voter (i.e. if A's delegates are not delegating at all), then the following rules shall be fulfilled:

If the primary delegate B chooses to vote directly, then A votes (through delegation) as B does. If the primary delegate B doesn't vote directly and doesn't delegate, but the secondary delegate C votes directly, then A votes (through delegation) as C does.

For all other cases (e.g. when one of A's delegates is delegating further), no assumptions are made at this point.

Property 2 ("Anonymity")

All voters are interchangeable with each other, as long as they behave in the same manner.

This property is also called "anonymity" in voting theory, [May, p.681] not to be confused with anonymous/secret voting. [PLF, p.148]

Property 3 ("Neutrality")

All voting options are interchangable with each other, e.g. replacing all direct YES votes with direct NO votes while replacing all direct NO votes with direct YES votes will simply exchange their vote counts: the total number of votes for YES will become the total number of votes for NO, and the total number of votes for NO will become the total number of votes for YES. Thus, a tie will stay a tie, the previous outcome of YES as winner would change into NO being winner, and the previous outcome of NO as winner would change into YES being winner of the voting procedure if all direct YES votes are replaced with direct NO votes and vice versa. See also [May, p.682].

Property 4 ("Consistency")

Unconnected subsets of the delegation graph can be considered separately (according to these 7 properties) and do not influence each other.

Property 5 ("Directionality")

Influence of delegation is directional, i.e. if we split the electorate into two subsets R and S, and if none of the persons in S delegate to any person in R, then the behavior of the voters in subset S is independent of any voter in R. In particular: one person A delegating to another person B may affect how A's vote is used but must not change how B's vote is used, as long as there is no circular delegation path leading back to A.

Note: A delegation system fulfilling Property 5 always fulfills Property 4 as well. Therefore, Property 5 is a generalization of Property 4.

Property 6 ("Equality of Direct and Delegating Voters")

Copying your delegates' votes according to Property 1 but acting as a directly voting person (instead of using the delegation system) doesn't change the outcome (i.e. the final vote counts) of the voting procedure. This rule only applies if the delegates whose votes are copied do not delegate futher. No assumptions are made otherwise (see also Property 1).

Fulfilling this property is particularly important to give all participants equal opportunities. Violating this property may cause some voters to have an advantage over other voters, depending on their social integration and/or technical abilities. [PLF, p.34-37]

Property 7 ("No Negative Voting Weight Through Delegation")

If a person A doesn't vote directly and doesn't delegate to anyone, and if (in a binary yes/no-decision) a person B votes via delegation in favor of a proposal that wins, then changing A's behavior to delegate to B instead of abstaining (i.e. neither voting directly nor delegating) must not cause the previously winning proposal to lose.

Impossibility to fulfill all 7 properties

As we will show in the remainder of this article, it is impossible to fulfill all 7 properties under the given assumptions (e.g. freedom of choice regarding one's delegates). To prove this theorem, we will have a look at the following 26 cases.

For the remainder of this article, we define:

p(x,y) := x, if x ≠ ∅, otherwise y.

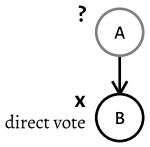
"∅" shall denote abstention from voting (i.e. neither voting directly nor through delegation). Primary delegation is depicted as an arrow, secondary delegation is depicted as a dashed arrow.

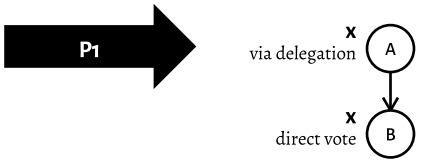
Note: In the following examples, Property 2 and Property 3 will be used implicitly until Case XXIV inclusive; the use of any other property will be explicitly noted in the text (and noted in the black arrows using a notation of "P1" for Property 1, and so on).

Case I

The first analyzed case consists of two voters: one voter B who directly casts a vote for option "x" (where x may be "YES" or "NO" in our example) and one voter A who delegates his or her decision to the other voter. Using Property 1, we can deduce that the delegating voter will also vote for "x" (via delegation).

x ∈ {YES, NO}

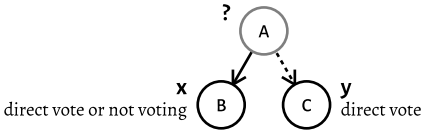




Case I

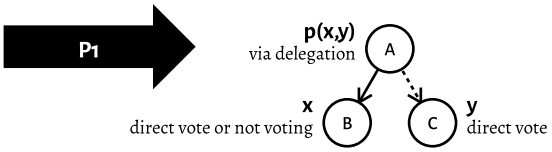
Case II

The second case consists of three voters: one voter B who either directly casts a vote for option “x” or abstains (i.e. doesn't vote and doesn't delegate), one voter C who directly casts a vote for option “y” (which may be equal to option “x” if voter B does not abstain), and one voter A who delegates his or her decision to the other two voters while selecting a preference in favor of voter B. Also here, we can use Property 1 to deduce how the delegating person's vote will be used. In this Case II, the delegating participant will vote for p(x,y) := [x, if x ≠ ∅, otherwise y] (whereas “∅” denotes abstention from voting).



x ∈ {YES, NO, ∅}

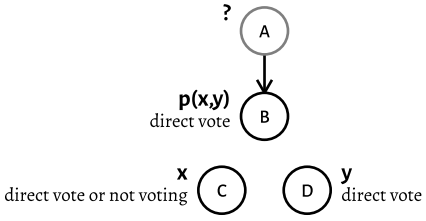
y ∈ {YES, NO}



Case II

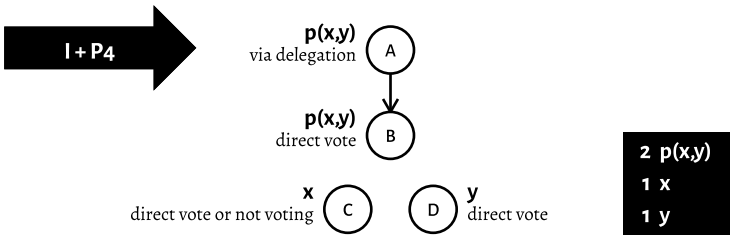
Case III

We consider a new Case III that can be solved by using the previously solved Case I and applying the rules of Property 4 ("Consistency").



x ∈ {YES, NO, ∅}

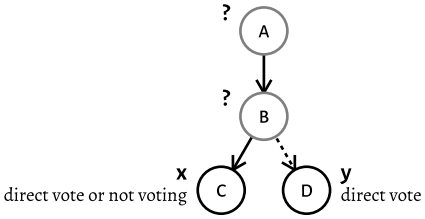
y ∈ {YES, NO}



Case III

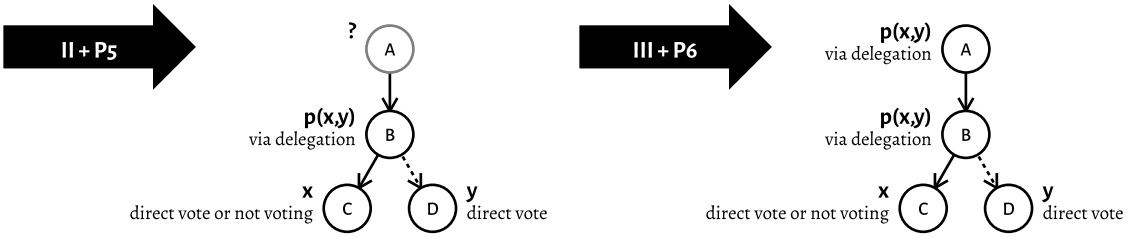
Case IV

We consider a new Case IV that can be solved by first applying the rules of Property 5 ("Directivity") to Case II in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case III to solve the last vote.



x ∈ {YES, NO, ∅}

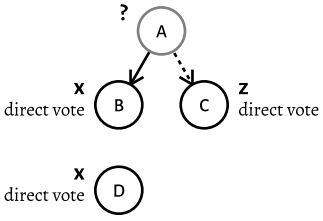
y ∈ {YES, NO}



Case IV

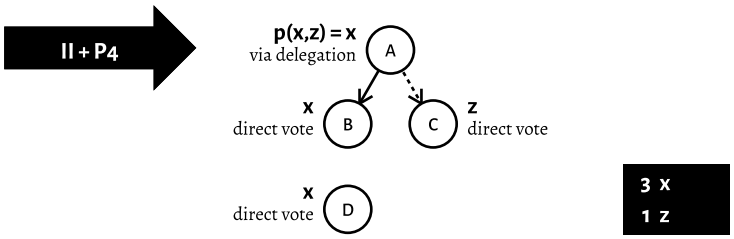
Case V

We consider a new Case V that can be solved by using the previously solved Case II and applying the rules of Property 4 ("Consistency").



x ∈ {YES, NO}

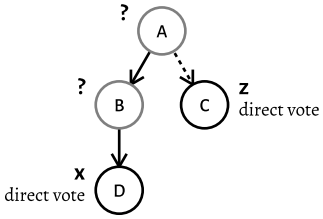
z ∈ {YES, NO}



Case V

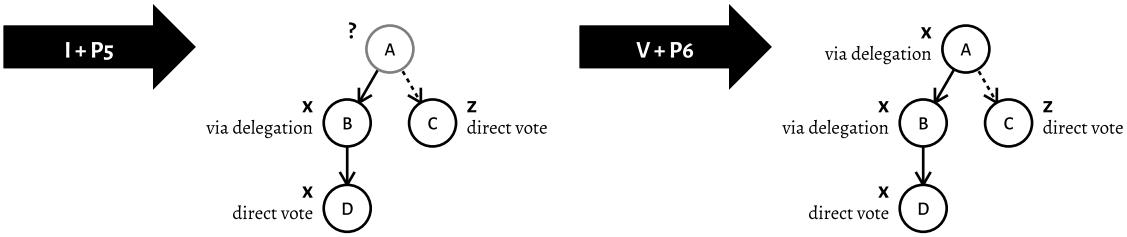
Case VI

We consider a new Case VI that can be solved by first applying the rules of Property 5 ("Directivity") to Case I in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case V to solve the last vote.



x ∈ {YES, NO}

z ∈ {YES, NO}



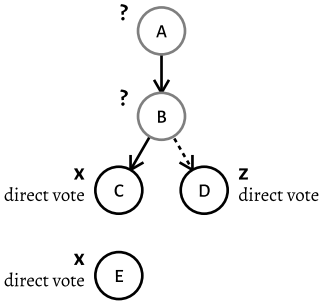
Case VI

Case VII

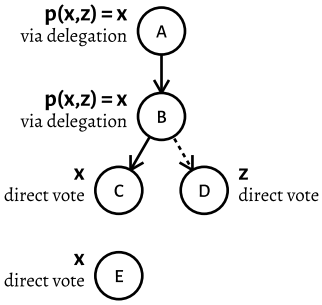
We consider a new Case VII that can be solved by using the previously solved Case IV and applying the rules of Property 4 ("Consistency").

x ∈ {YES, NO}

z ∈ {YES, NO}



IV + P4

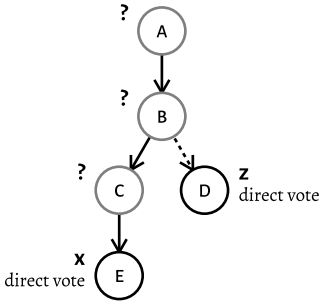


4 x
1 z

Case VII

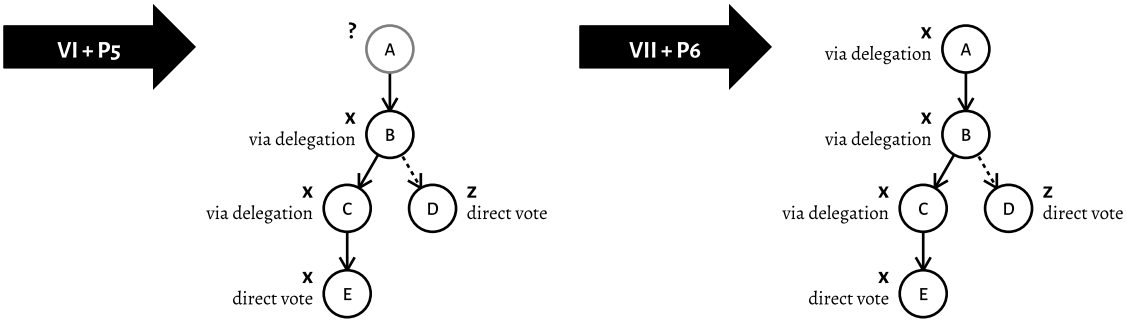
Case VIII

We consider a new Case VIII that can be solved by first applying the rules of Property 5 ("Directivity") to Case VI in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case VII to solve the last vote.



x ∈ {YES, NO}

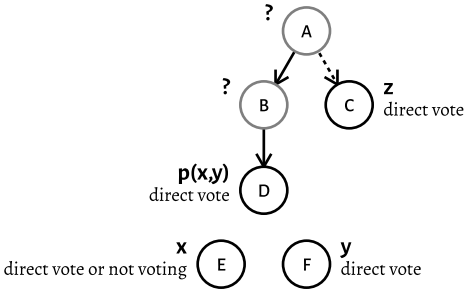
z ∈ {YES, NO}



Case VIII

Case IX

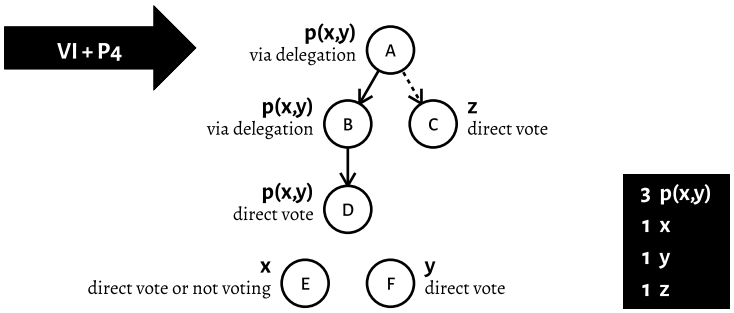
We consider a new Case IX that can be solved by using the previously solved Case VI and applying the rules of Property 4 ("Consistency").



$x \in \{YES, NO, \emptyset\}$

$y \in \{YES, NO\}$

$z \in \{YES, NO\}$

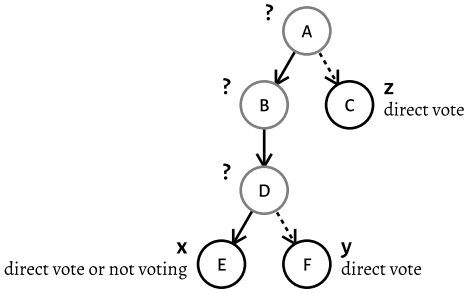


3 p(x,y)
1 x
1 y
1 z

Case IX

Case X

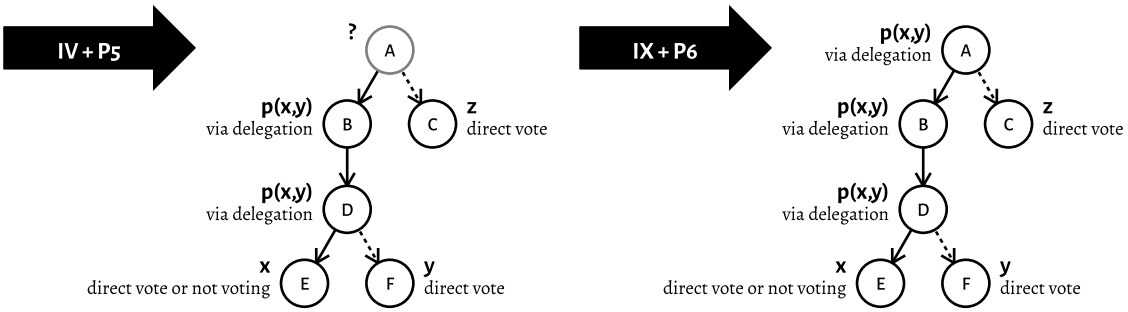
We consider a new Case X that can be solved by first applying the rules of Property 5 ("Directivity") to Case IV in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case IX to solve the last vote.



x ∈ {YES, NO, ∅}

y ∈ {YES, NO}

z ∈ {YES, NO}



Case X

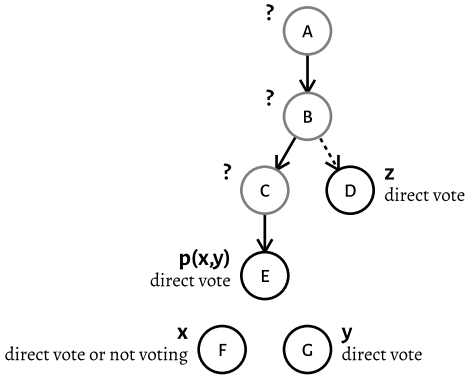
Case XI

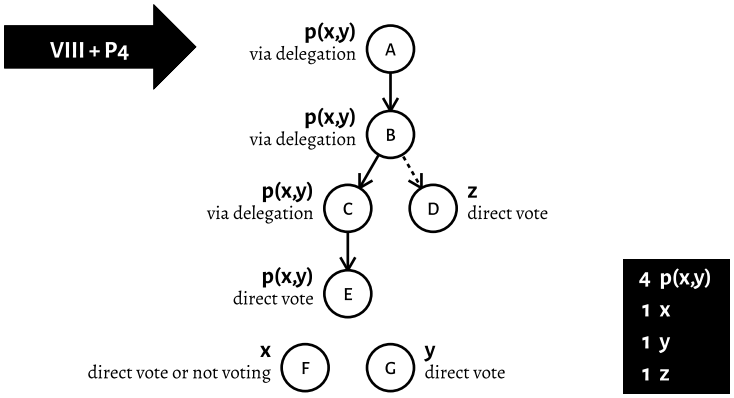
We consider a new Case XI that can be solved by using the previously solved Case VIII and applying the rules of Property 4 ("Consistency").

$x \in \{YES, NO, \varnothing\}$

$y \in \{YES, NO\}$

$z \in \{YES, NO\}$

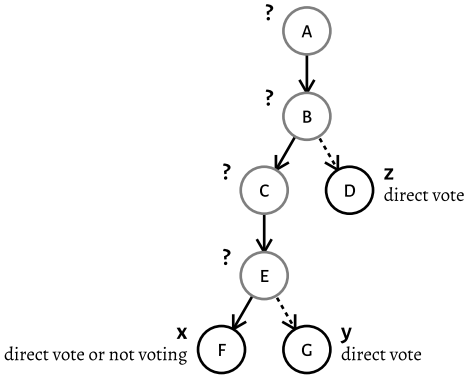




Case XI

Case XII

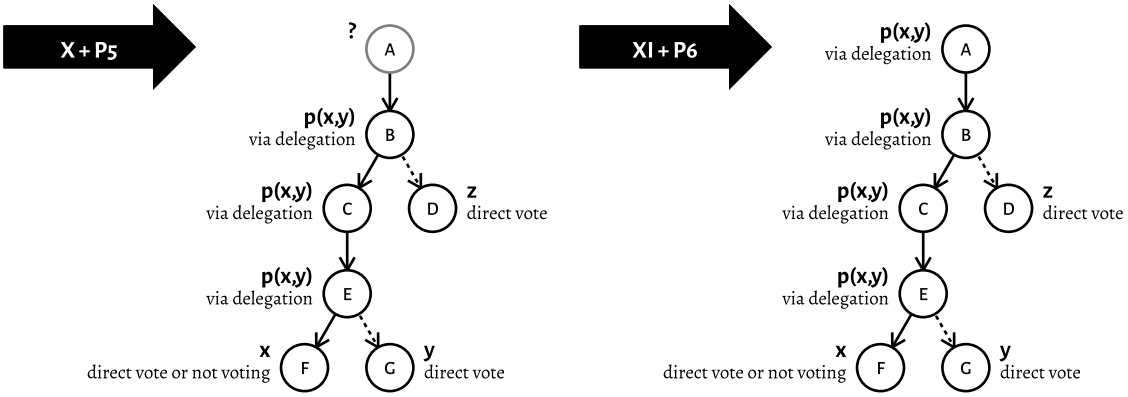
We consider a new Case XII that can be solved by first applying the rules of Property 5 ("Directivity") to Case X in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case XI to solve the last vote.



x ∈ {YES, NO, ∅}

y ∈ {YES, NO}

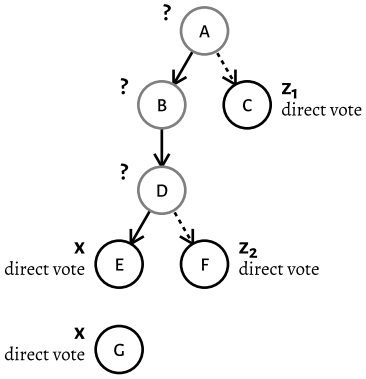
z ∈ {YES, NO}



Case XII

Case XIII

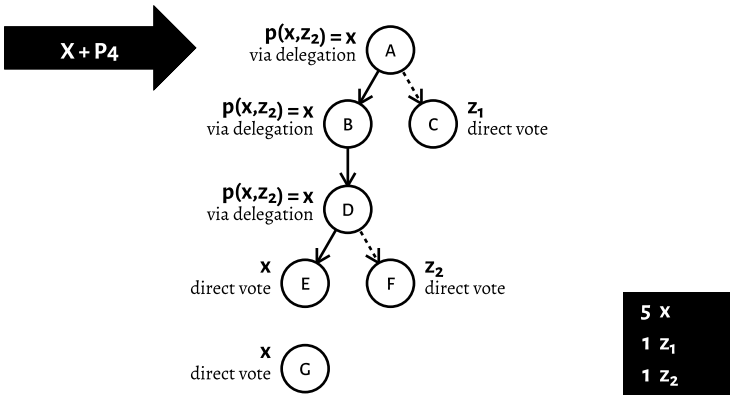
We consider a new Case XIII that can be solved by using the previously solved Case X and applying the rules of Property 4 ("Consistency").



$x \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

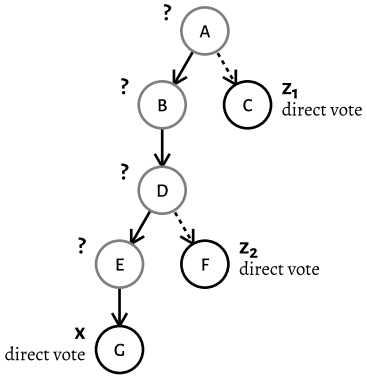
$z_2 \in \{YES, NO\}$



Case XIII

Case XIV

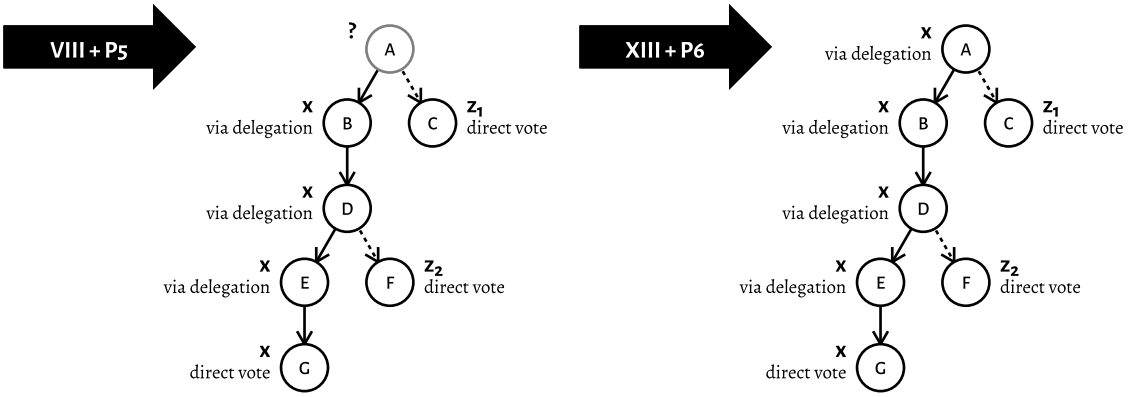
We consider a new Case XIV that can be solved by first applying the rules of Property 5 ("Directivity") to Case VIII in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case XIII to solve the last vote.



$x \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$



Case XIV

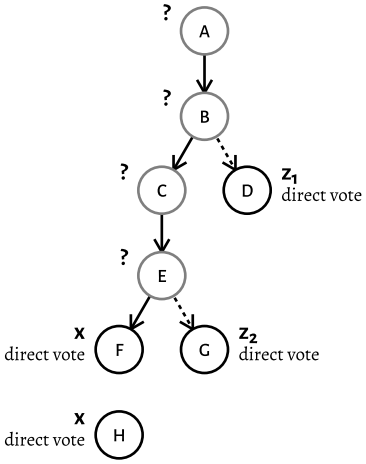
Case XV

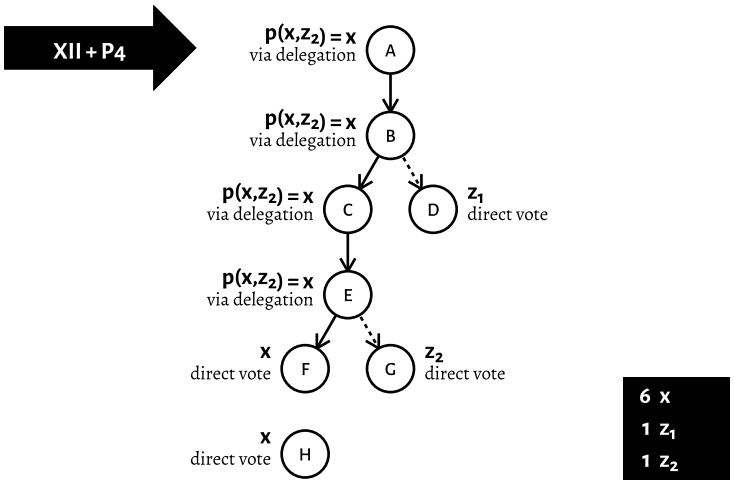
We consider a new Case XV that can be solved by using the previously solved Case XII and applying the rules of Property 4 ("Consistency").

$x \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$

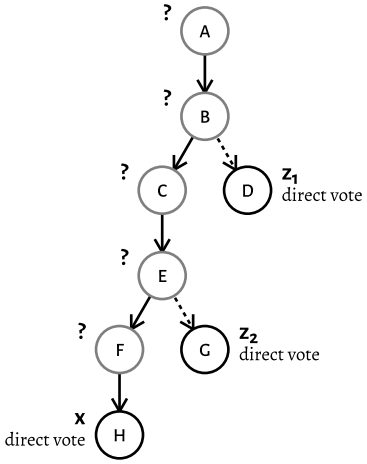




Case XV

Case XVI

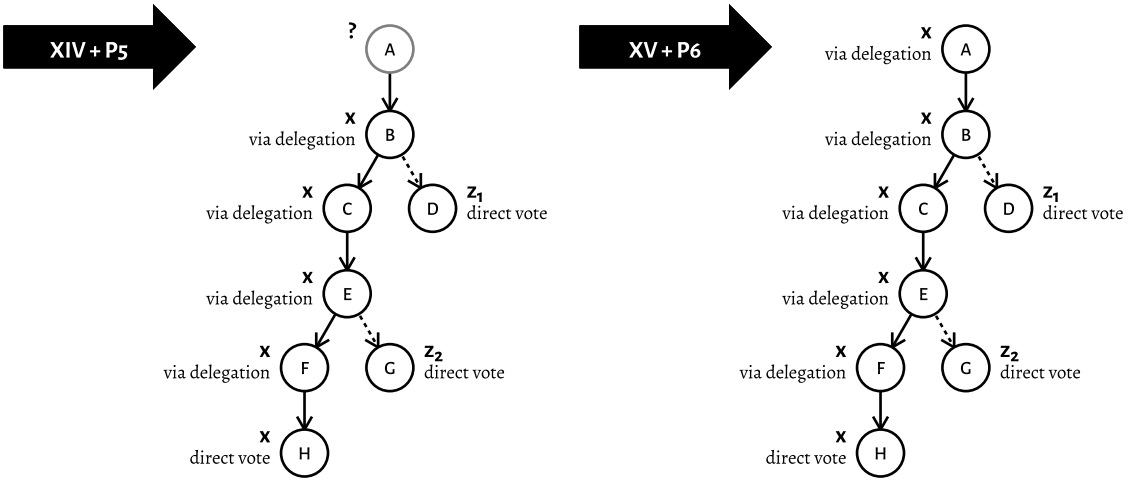
We consider a new Case XVI that can be solved by first applying the rules of Property 5 ("Directivity") to Case XIV in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case XV to solve the last vote.



$x \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$



Case XVI

Case XVII

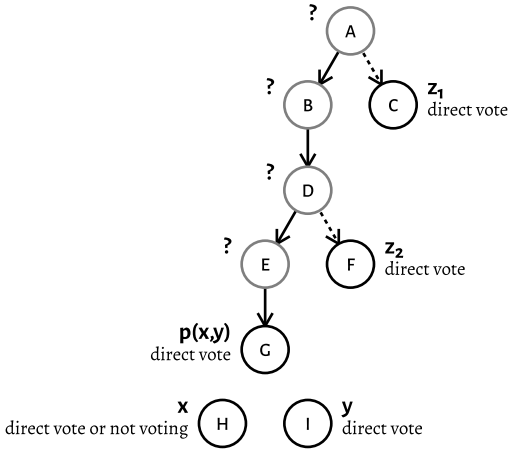
We consider a new Case XVII that can be solved by using the previously solved Case XIV and applying the rules of Property 4 ("Consistency").

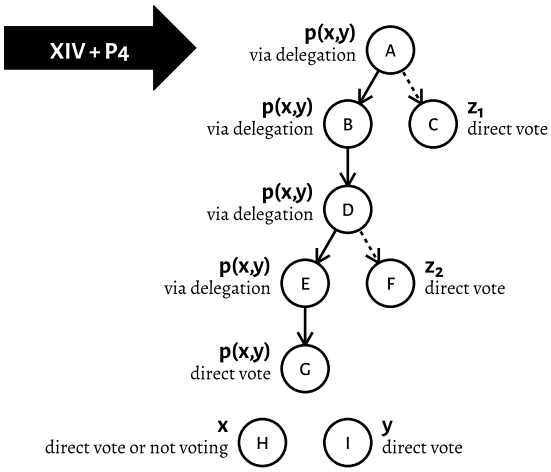
$x \in \{YES, NO, \varnothing\}$

$y \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$



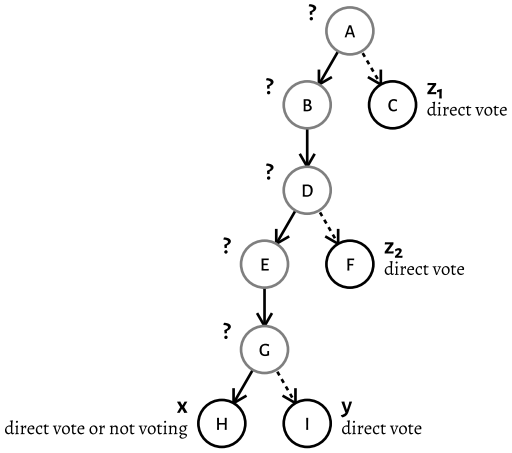


5 p(x,y)
1 x
1 y
1 z_1
1 z_2

Case XVII

Case XVIII

We consider a new Case XVIII that can be solved by first applying the rules of Property 5 ("Directivity") to Case XII in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case XVII to solve the last vote.

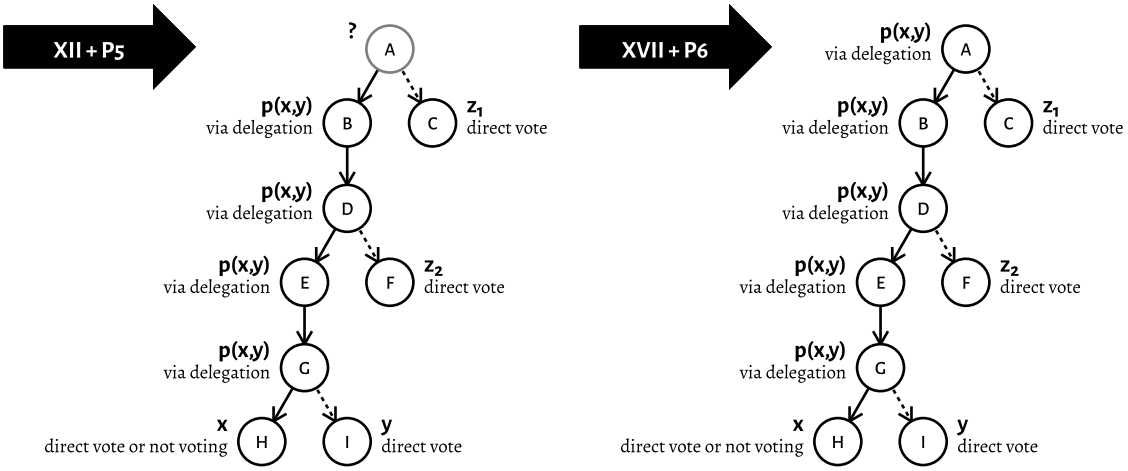


$x \in \{YES, NO, \emptyset\}$

$y \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$



Case XVIII

Case XIX

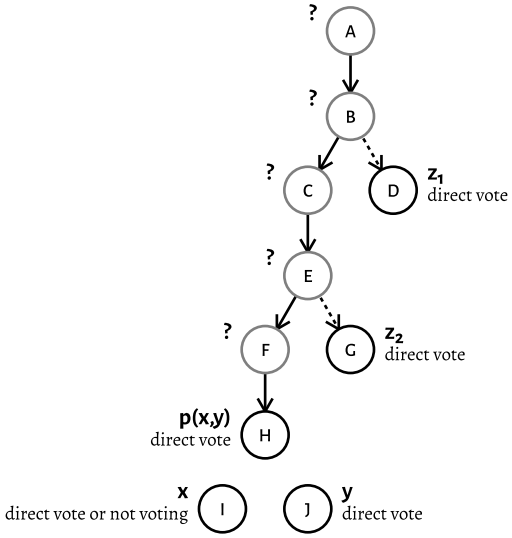
We consider a new Case XIX that can be solved by using the previously solved Case XVI and applying the rules of Property 4 ("Consistency").

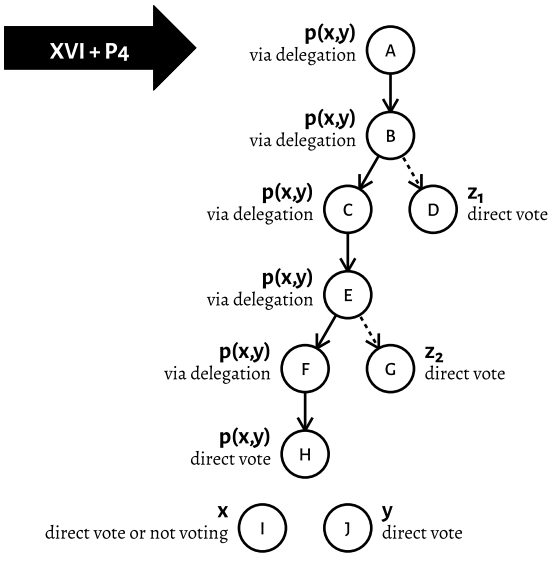
$x \in \{YES, NO, \varnothing\}$

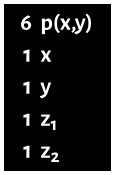
$y \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$







Case XIX

Case XX

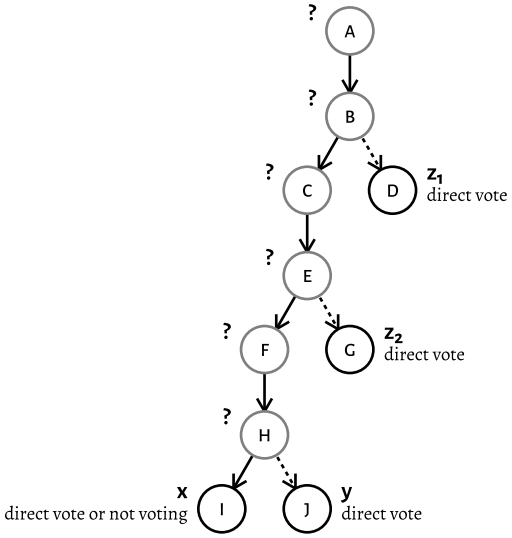
We consider a new Case XX that can be solved by first applying the rules of Property 5 ("Directivity") to Case XVIII in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case XIX to solve the last vote.

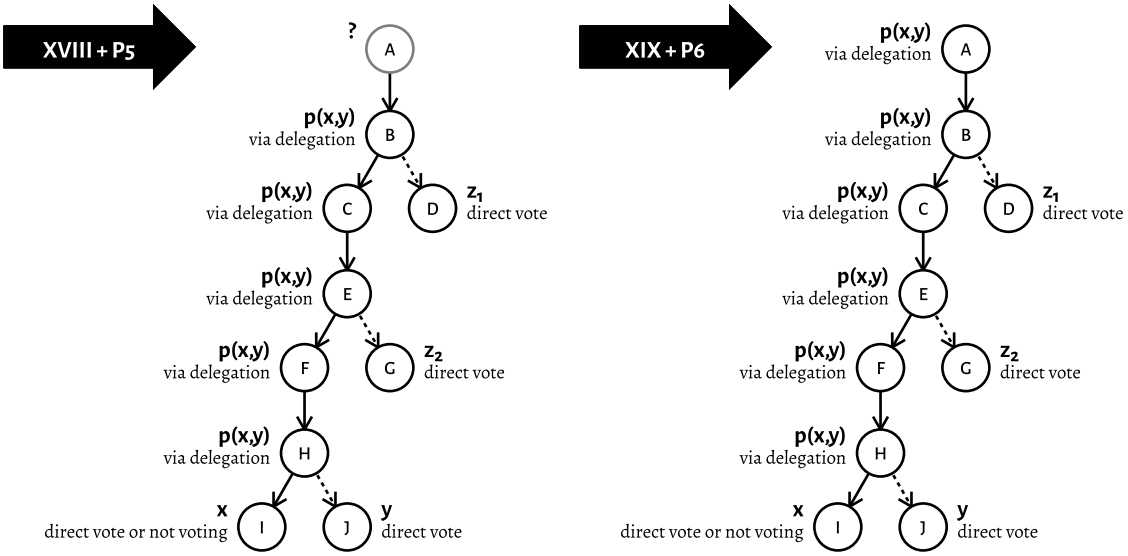
$x \in \{YES, NO, \emptyset\}$

$y \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$





Case XX

Case XXI

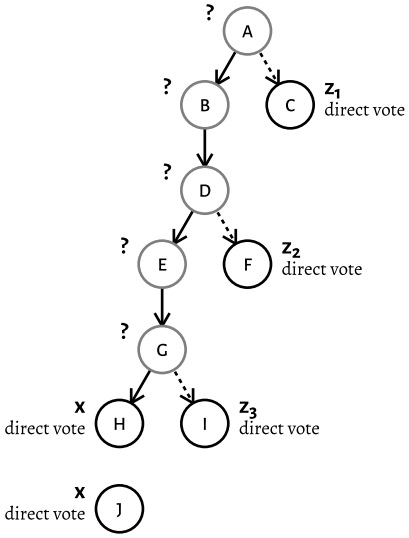
We consider a new Case XXI that can be solved by using the previously solved Case XVIII and applying the rules of Property 4 ("Consistency").

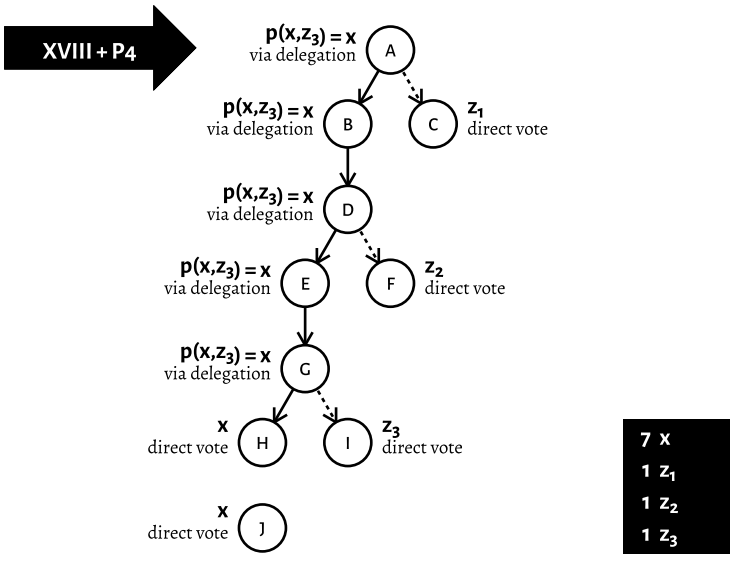
$x \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$

$z_3 \in \{YES, NO\}$

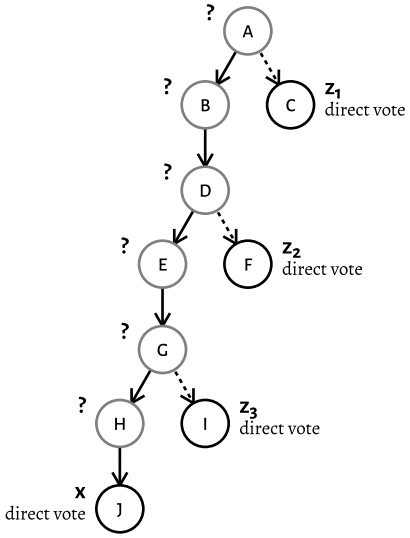




Case XXI

Case XXII

We consider a new Case XXII that can be solved by first applying the rules of Property 5 ("Directivity") to Case XVI in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case XXI to solve the last vote.

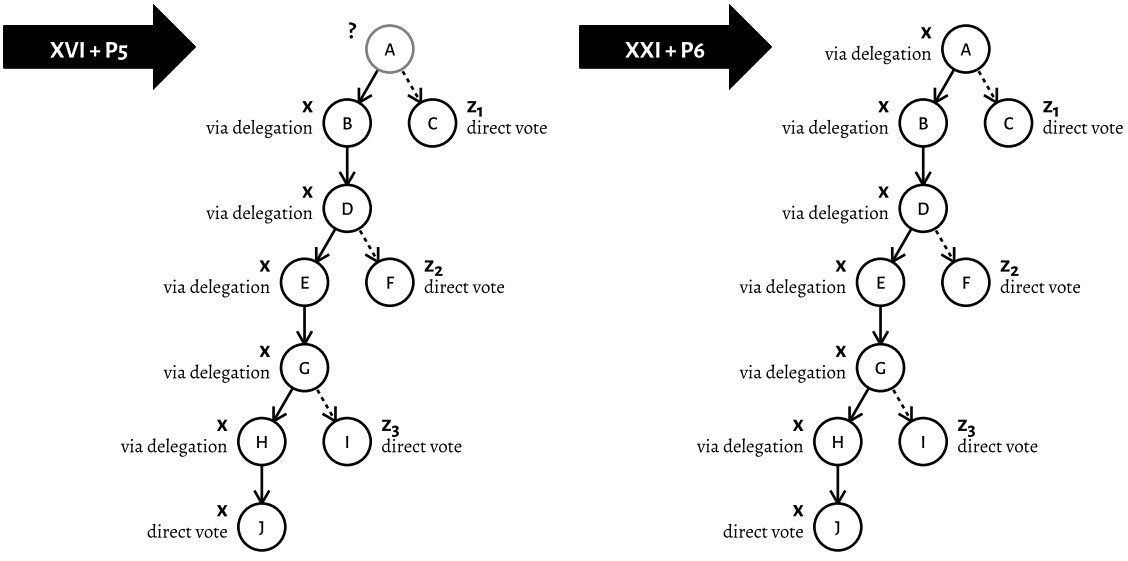


$x \in \{YES, NO\}$

$z_1 \in \{YES, NO\}$

$z_2 \in \{YES, NO\}$

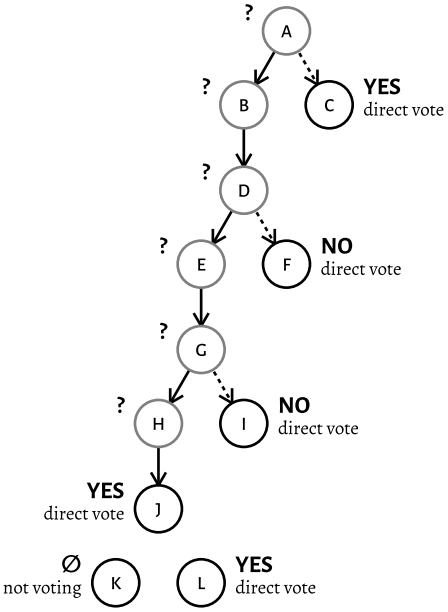
$z_3 \in \{YES, NO\}$

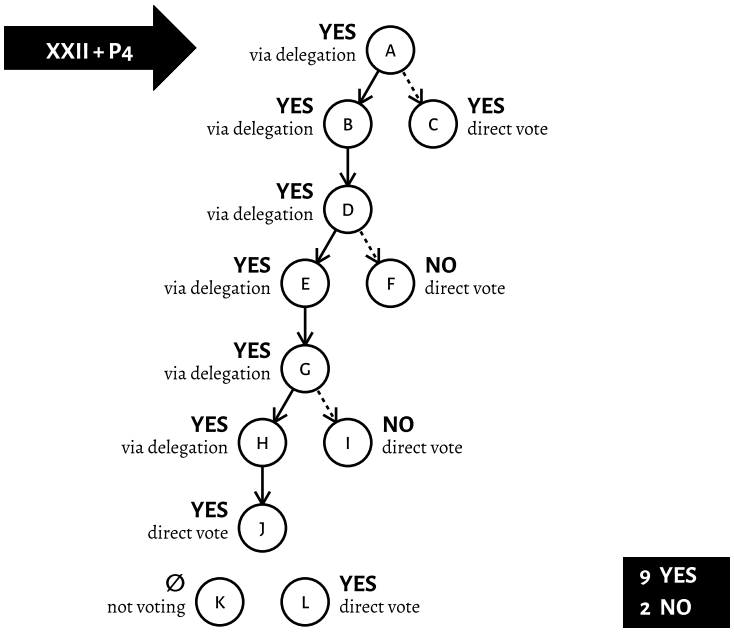


Case XXII

Case XXIII

We consider a new Case XXIII that can be solved by using the previously solved Case XXII and applying the rules of Property 4 ("Consistency").

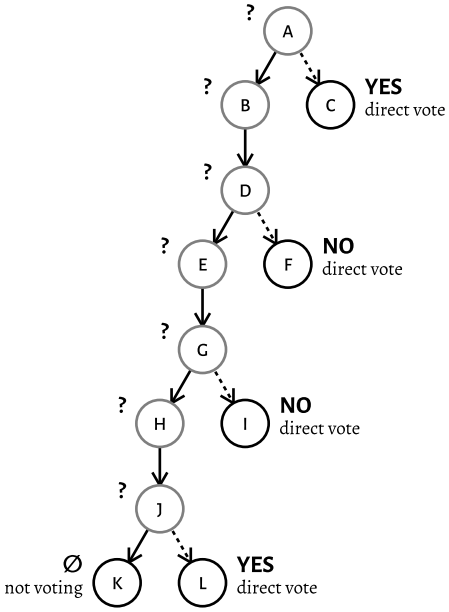


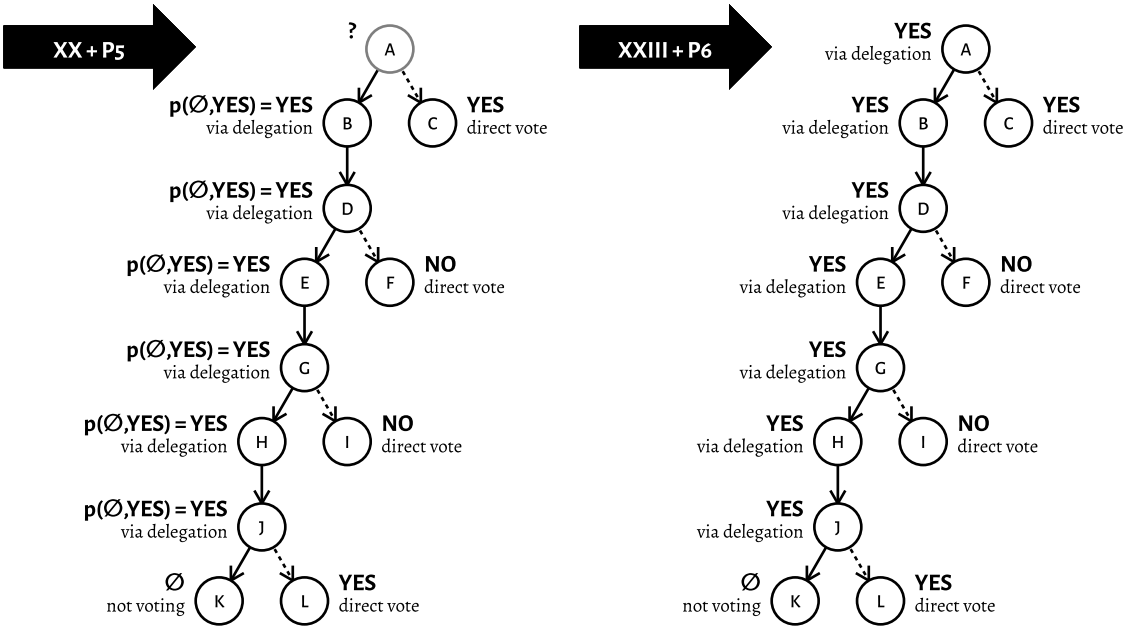


Case XXIII

Case XXIV

We consider a new Case XXIV that can be solved by first applying the rules of Property 5 ("Directivity") to Case XX in order to determine all votes but one, and then, due to Property 6 ("Equality of Direct and Delegating Voters"), using the vote counts determined in Case XXIII to solve the last vote.

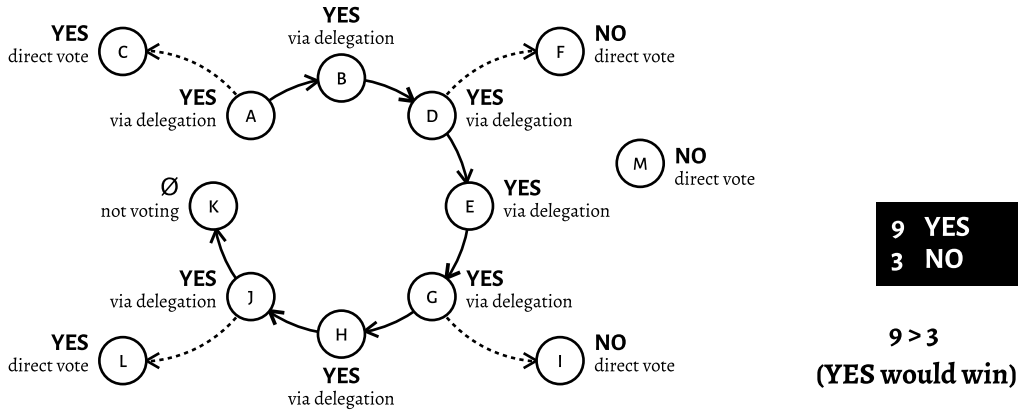




Case XXIV

Case XXV

We copy the delegation graph from Case XXIV and add a single NO vote (using Property 4). Despite adding a NO vote, the number of YES votes still outnumbers the number of NO votes. Thus "YES" would still win here.



Case XXV

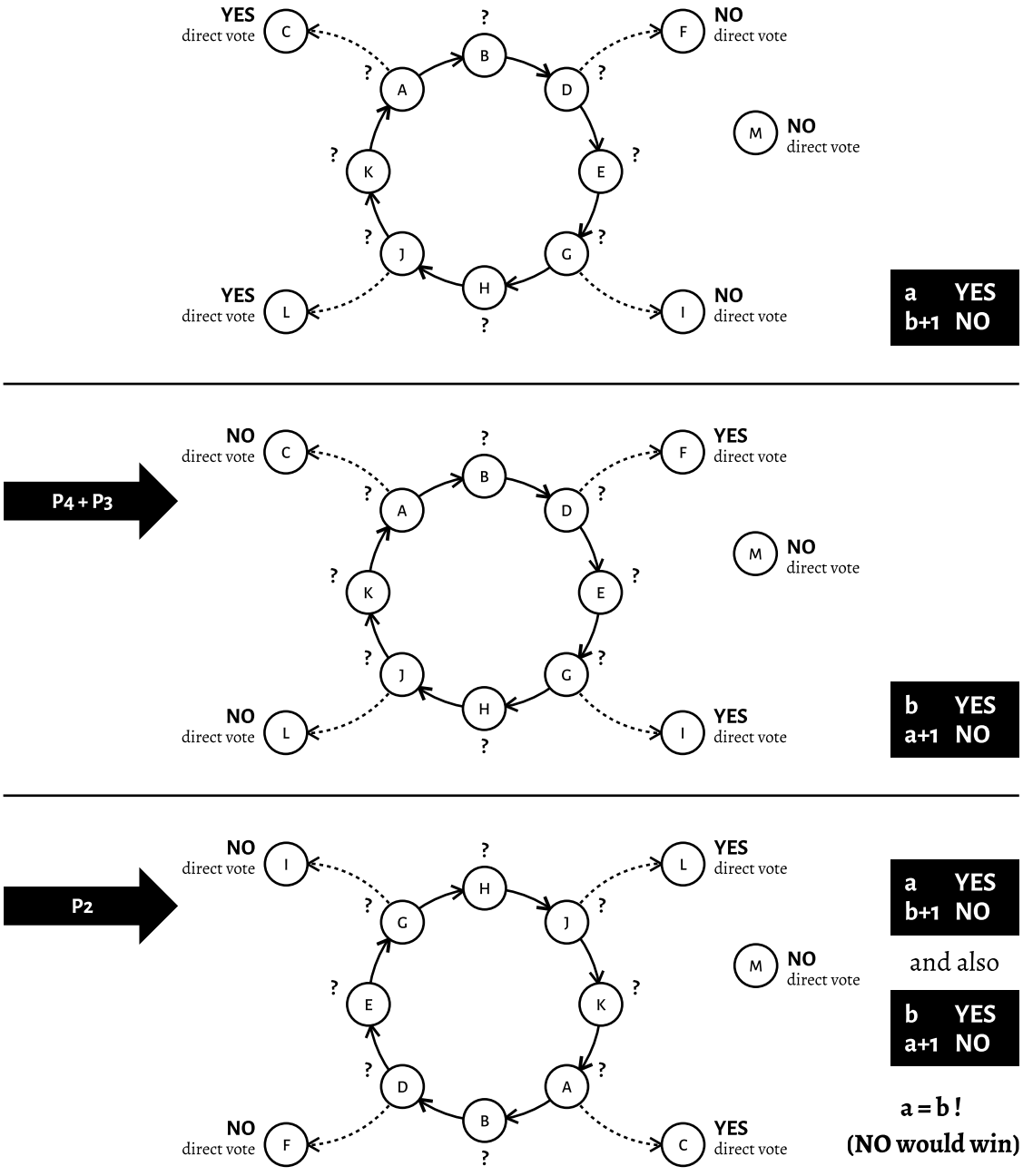
Case XXVI

We create a final Case XXVI equal to Case XXV but with the sole difference that voter K (who was previously abstaining) delegates to voter A (who was previously voting for YES through delegation). According to Property 7, "YES" would need to win in Case XXVI (because it also wins in Case XXV). However, due to symmetry of the circular structure in Case XXVI (using Property 4, Property 3, and Property 2 to transform the circular structure), we can show that (because of voter M) there must be more "NO" votes than "YES" votes, which, in turn, means that Property 7 is contradictory to the previously defined properties,

quod erat demonstrandum.

Case XXVI (part 1 of 2)

Case XXVI (cont.)



Case XXVI (part 2 of 2)

[PLF] Behrens, Kistner, Nitsche, Swierczek: "The Principles of LiquidFeedback". ISBN 978-3-00-044795-2. Published January 2014 by Interaktive Demokratie e. V., available at http://principles.liquidfeedback.org/

[May] Kenneth O. May: A Set of Independent Necessary and Sufficient Conditions for Simple Majority Decision. In "Econometrica, Vol. 20, No. 4" (October 1952), pp. 680–684. Published by the Econometric Society (Wiley-Blackwell).

Circular Delegations - Myth or Disaster?

by Jan Behrens, Berlin, January 23, 2015

About 6 years ago, when we started to form the basic concepts of LiquidFeedback, we often heard people worrying about the problem of "circular delegations": what happens if Alice delegates to Bob, Bob delegates to Chris, and Chris delegates to Alice? In our book, "The Principles of LiquidFeedback", we explained that cyclic delegations are a nonexistent problem, because if all people in a cycle just delegate, then none of them will vote; while if one person casts a vote, the cycle will break automatically. [PLF, subsection 2.4.1 ("The myth of circular delegations")]

The problem, however, is only nonexistent because if all people in a cycle delegate, none of the connected nodes in the delegation graph can unfold activities since any activity would break the cycle: as soon as somebody casts a vote, their (outgoing) delegation will be suspended (also compare Figures 2.6, 2.7, and 2.8 in [PLF]). We might assume that a revisitation of the previously dismissed issue of cyclic delegations is necessary if we extend the delegation model in such a way that (using a preference list) it is possible to delegate a decision to more than one person.

While there is probably an infinite number of possibilities to implement preferential delegation systems (and thus how to solve cyclic delegations), we were able to make a general statement about all preferential voting systems independently of the particular rules in effect to solve cyclic delegations. It could be shown that taking certain self-evident properties as given (Properties 2 through 5 in [PD]), any voting system will either treat directly and delegating voters unequally (violation of Property 6 in [PD]) or is prone to negative voting weight (violation of Property 7 in [PD]) if the voters' freely chosen delegates are respected (at least in trivial cases, see Property 1 in [PD]).

If we aim at treating all voters equally, we must ensure that direct and delegating voters are treated equally. [PLF, subsection 2.4.2] Following this political requirement, no matter which preferential delegation system we construct, it will be either susceptible to negative voting

weight (violation of Property 7) or ignoring voters' preferences due to violation of Property 1 or disallowing voters to express their true preference if there is a cycle.

Summary

Circular delegations are still a nonexistent problem for the delegation model used by LiquidFeedback, but extending or replacing the model with preferential delegation will either lead to paradox situations in certain cases (negative voting weight, or disallowing voters to express their true preference) or break the important property of treating delegating and direct voters equally. It is important not to sacrifice the latter property, however, as it ensures equal opportunities for all participants. [PLF, subsection 2.4.2 ("Delegations and 'one man – one vote'")]

[PLF] Behrens, Kistner, Nitsche, Swierczek: "The Principles of LiquidFeedback". ISBN 978-3-00-044795-2. Published January 2014 by Interaktive Demokratie e. V., available at http://principles.liquidfeedback.org/

[PD] Jan Behrens & Björn Swierczek: Preferential Delegation and the Problem of Negative Voting Weight. In "The Liquid Democracy Journal on electronic participation, collective moderation, and voting systems, Issue 3" (2015-01-23). ISSN 2198-9532. Published by Interaktive Demokratie e. V.

Also published by Interaktive Demokratie e.V.:

The Principles of LiquidFeedback

This book gives an in-depth insight into the philosophical, political and technological aspects of decision making using the internet and the "secrets" of LiquidFeedback, a computer software designed to empower organizations to make democratic decisions independent of physical assemblies, giving every member of the organization an equal opportunity to participate in the democratic process.

The inventors of LiquidFeedback explain the principles and rules of procedure developed for LiquidFeedback providing the key features for democratic self-organization. They give a theoretical background about collective decision making and answers to practical questions. This is a must-read for anybody planning to make online decisions or to build online decision platforms and is also interesting for anybody interested in the future of democracy in the digital age.

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- explanation of the structured discussion process in LiquidFeedback, including:
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  - protection of minorities and the problem of "noisy minorities"
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