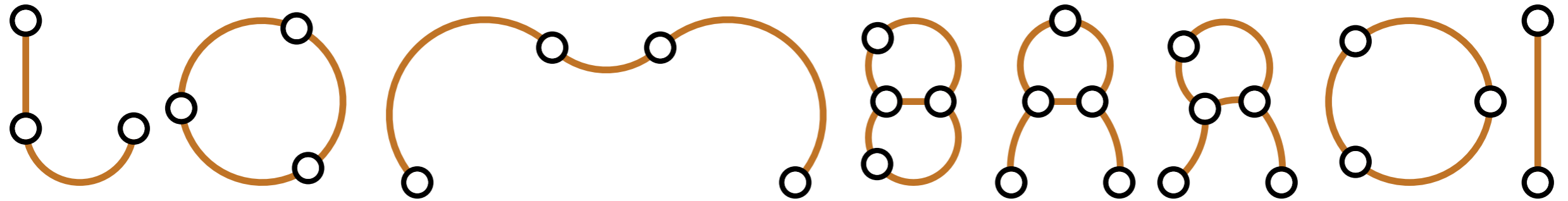


PLANAR & POLY-ARC



DRAWINGS

Christian Duncan

David Eppstein

Michael Goodrich

Stephen Kobourov

Maarten Löffler

PAST MARK LOMBARDI

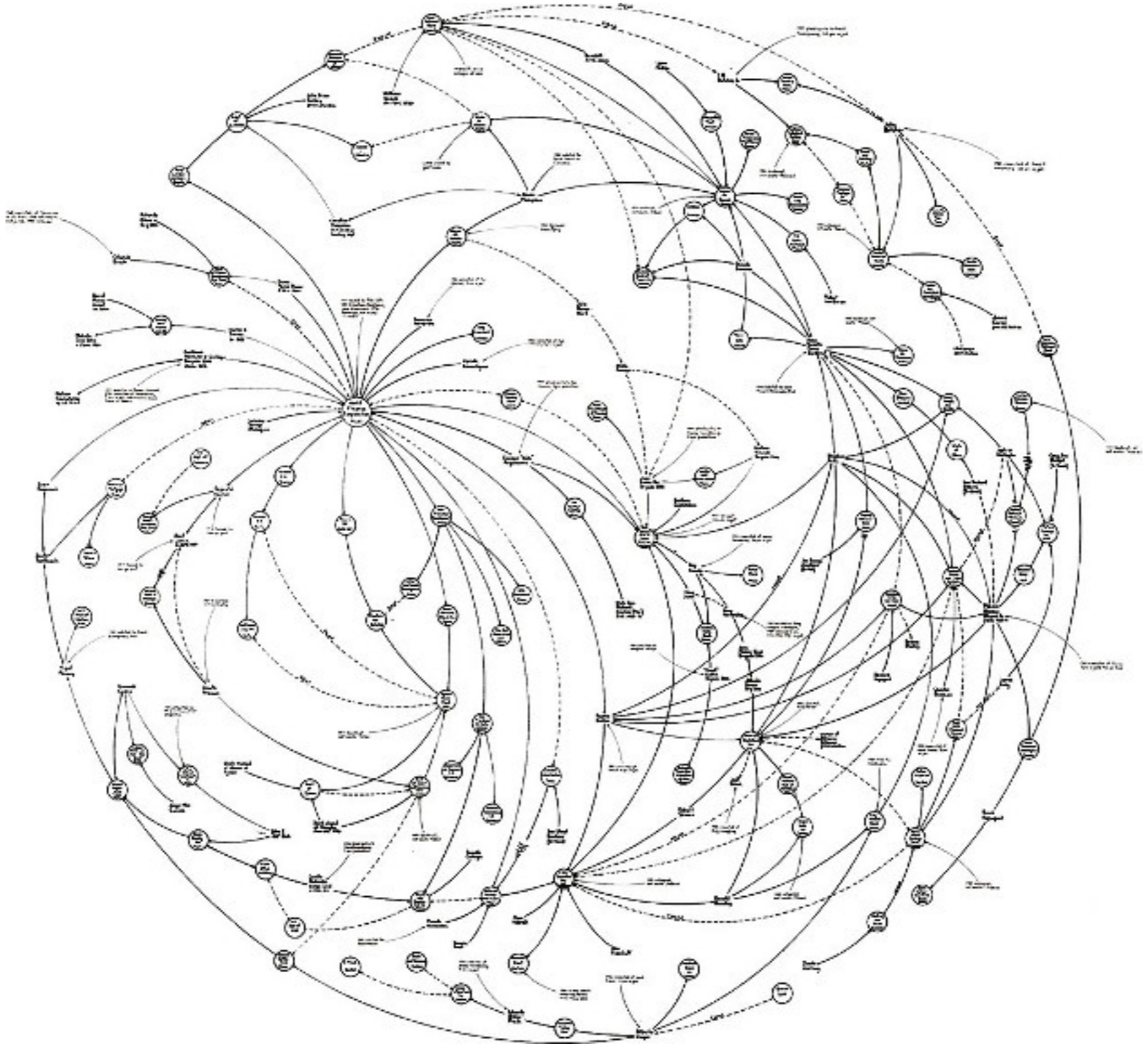
GRAPH DRAWING 2011, EINDHOVEN

MAARTEN LÖFFLER

STEPHEN KOBOUROV

MICHAEL GOODRICH

PAST MARK LOMBARDI

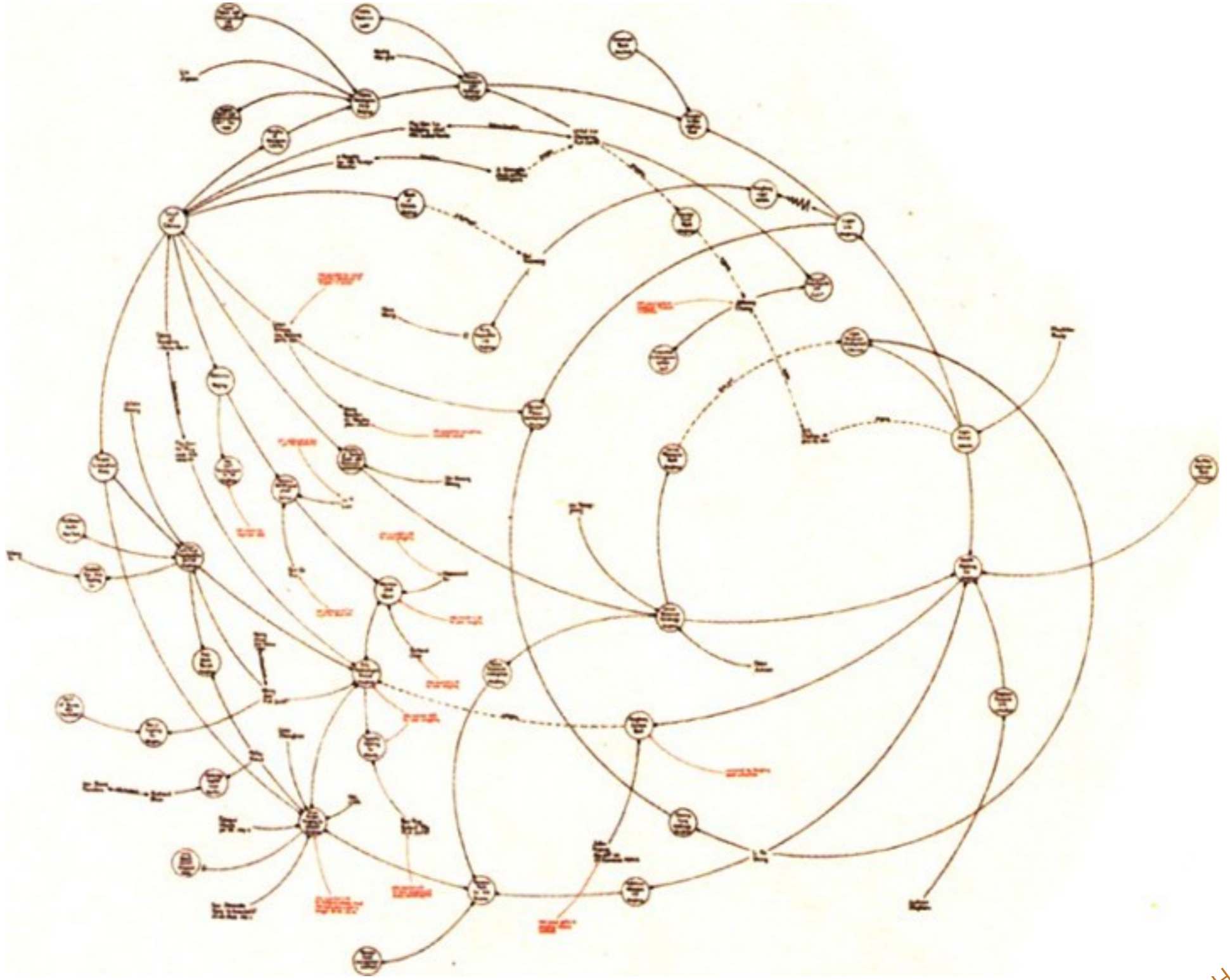


GRAPH DRAWING 2011, EINDHOVEN

MAARTEN LÖFFLER

STEPHEN KOBouROV · MICHAEL GOODRICH

PAST MARK LOMBARDI



PAST LOMBARDI DRAWINGS

GRAPH DRAWING 2011, EINDHOVEN

MAARTEN LÖFFLER

STEPHEN KOBOUROV · MICHAEL GOODRICH

CHRISTIAN DUNCAN · DAVID EPPSTEIN

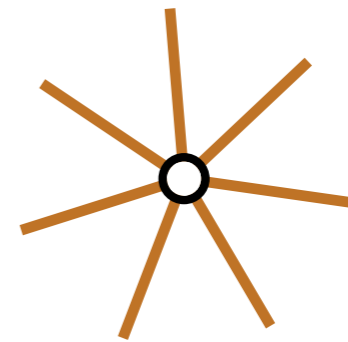
PLANAR AND POLY-ARC LOMBARDI DRAWINGS

PAST LOMBARDI DRAWINGS

Def: *Lombardi vertex*
Perfect angular
resolution.

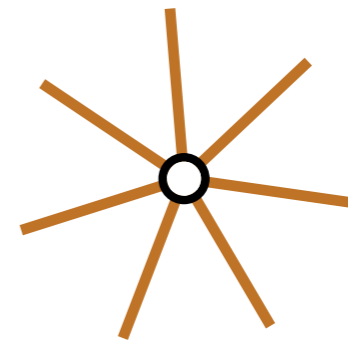
PAST LOMBARDI DRAWINGS

Def: *Lombardi vertex*
Perfect angular
resolution.



PAST LOMBARDI DRAWINGS

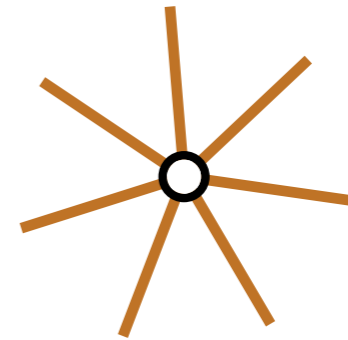
Def: *Lombardi vertex*
Perfect angular
resolution.



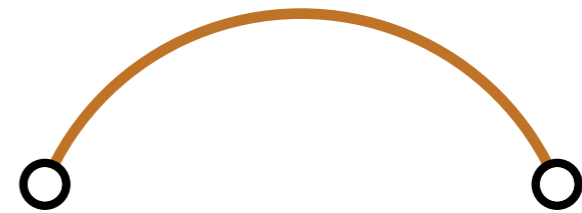
Def: *Lombardi edge*
Single circular arc.

PAST LOMBARDI DRAWINGS

Def: *Lombardi vertex*
Perfect angular
resolution.

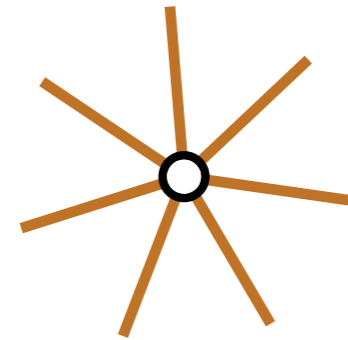


Def: *Lombardi edge*
Single circular arc.

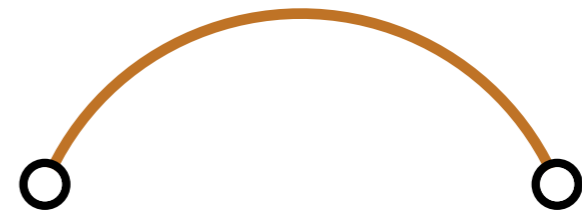


PAST LOMBARDI DRAWINGS

Def: *Lombardi vertex*
Perfect angular
resolution.

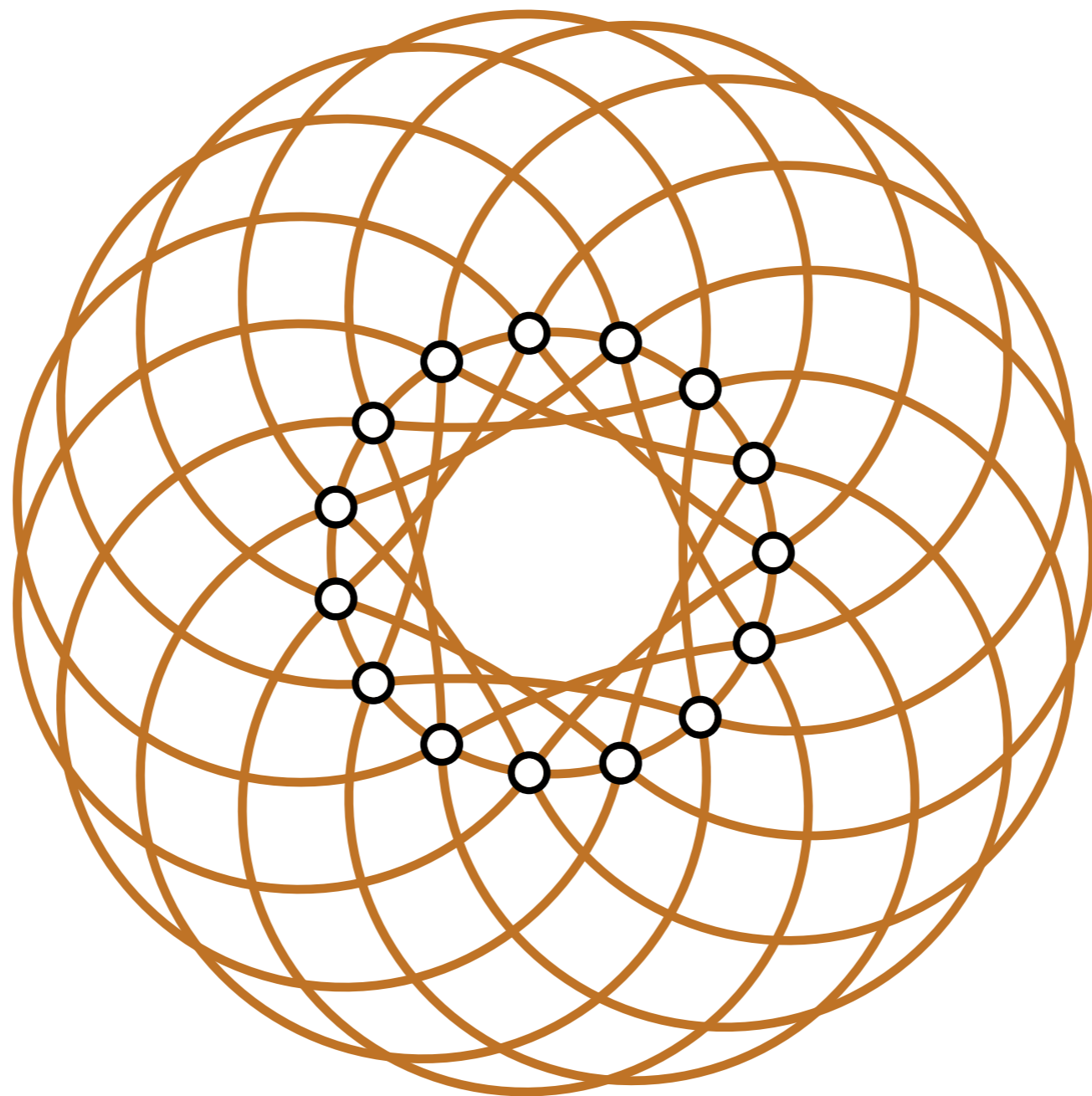


Def: *Lombardi edge*
Single circular arc.



(Duncan *et al.*, 2010)

PAST LOMBARDI DRAWINGS



GRAPH DRAWING 2011, EINDHOVEN

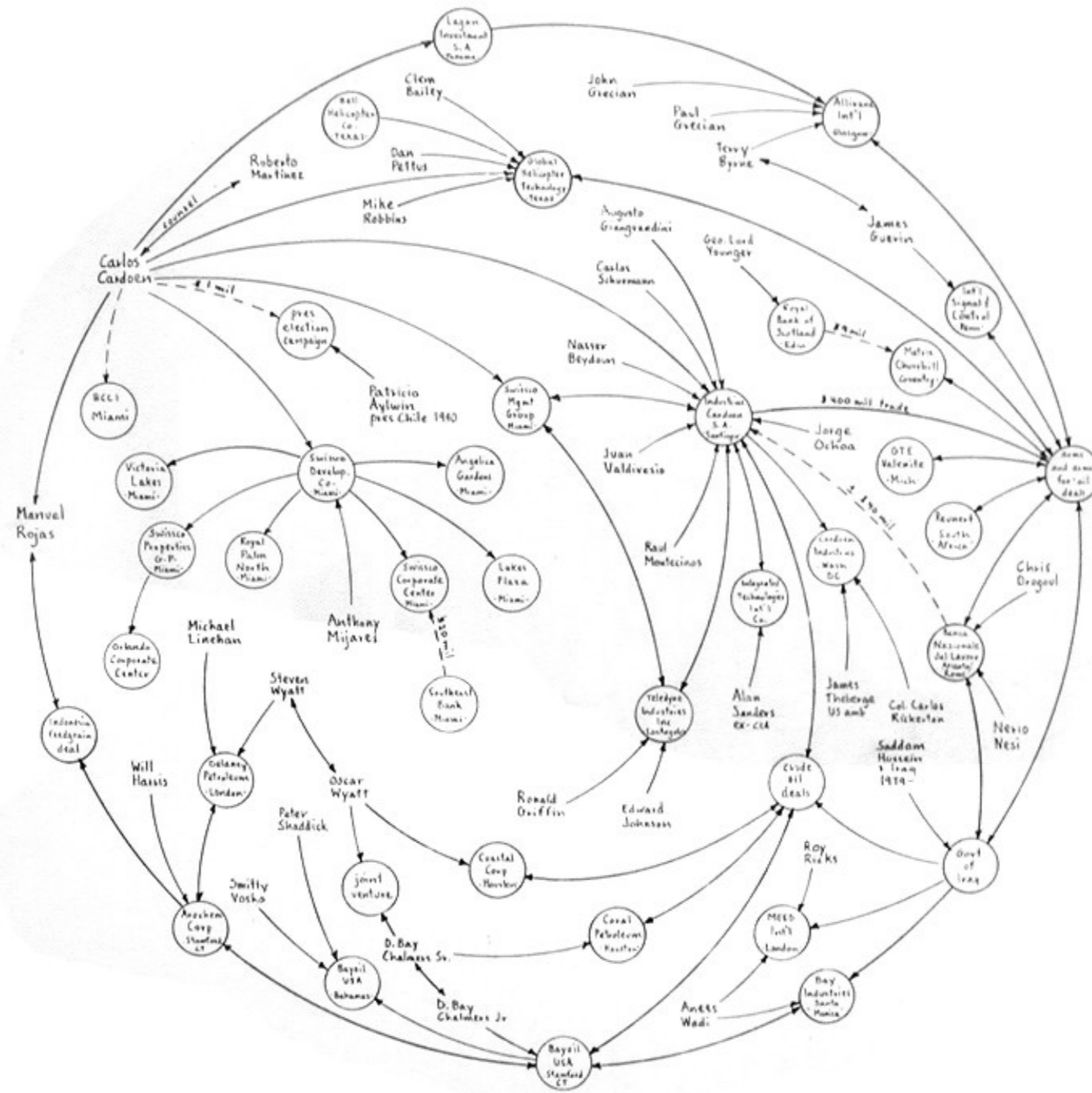
MAARTEN LÖFFLER

STEPHEN KOBOUROV

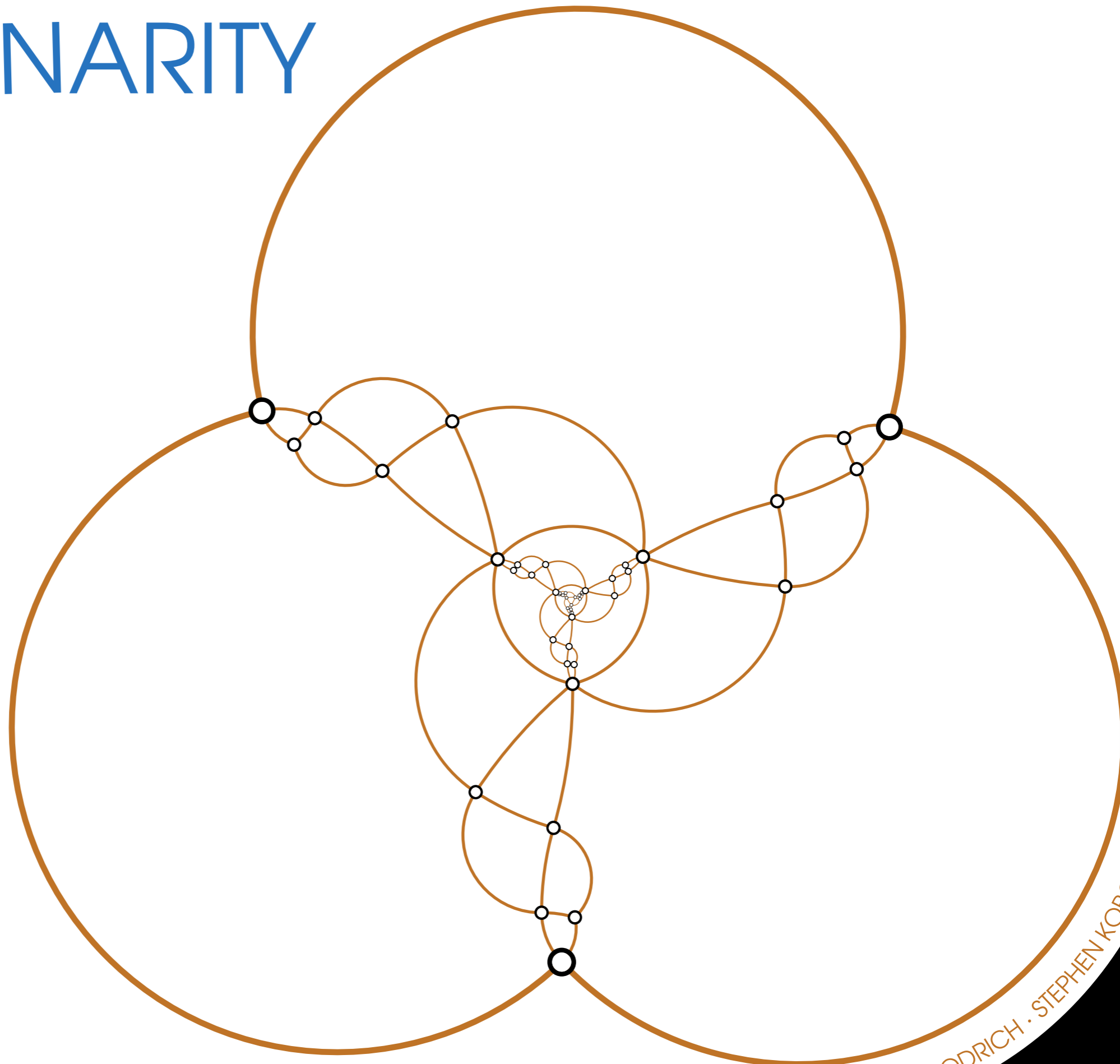
MICHAEL GOODRICH

PAST PLANARITY

PAST PLANARITY



PAST PLANARITY



GRAPH DRAWING 2011, EINDHOVEN

MAARTEN LÖFFLER

STEPHEN KOBOUROV

PAST KNOWN RESULTS

PAST KNOWN RESULTS

Theorem: Not every embedding of every graph has a Lombardi drawing.

PAST KNOWN RESULTS

Theorem: Not every embedding of every graph has a Lombardi drawing.

Theorem: Not every planar graph has a planar Lombardi drawing.

PAST KNOWN RESULTS

Theorem: Not every embedding of every graph has a Lombardi drawing.

Theorem: Not every planar graph has a planar Lombardi drawing.

(Duncan *et al.*, 2010)

PRESENT LOMBARDI DRAWINGS

GRAPH DRAWING 2011, EINDHOVEN

MAARTEN LÖFFLER

STEPHEN KOBOUROV

MICHAEL GOODRICH

PRESENT LOMBARDI DRAWINGS

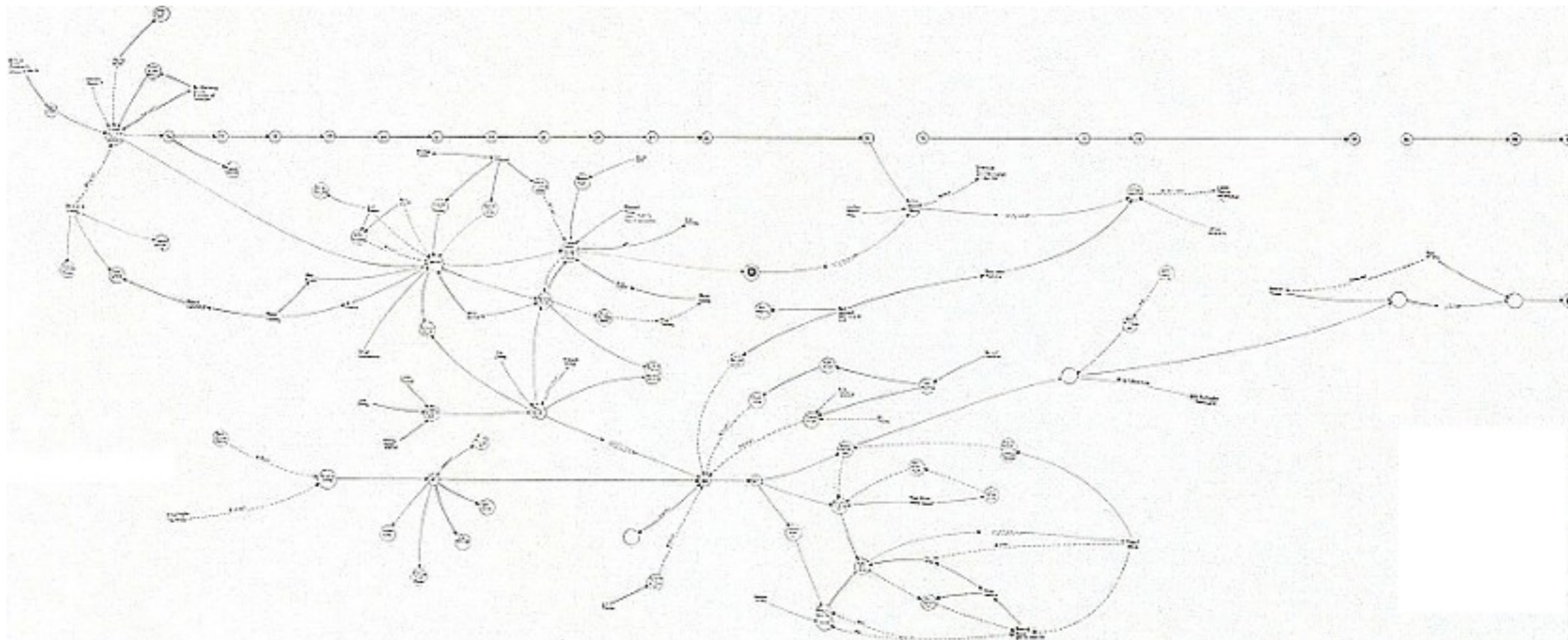
How can we draw graphs
without Lombardi drawings?

PRESENT LOMBARDI DRAWINGS

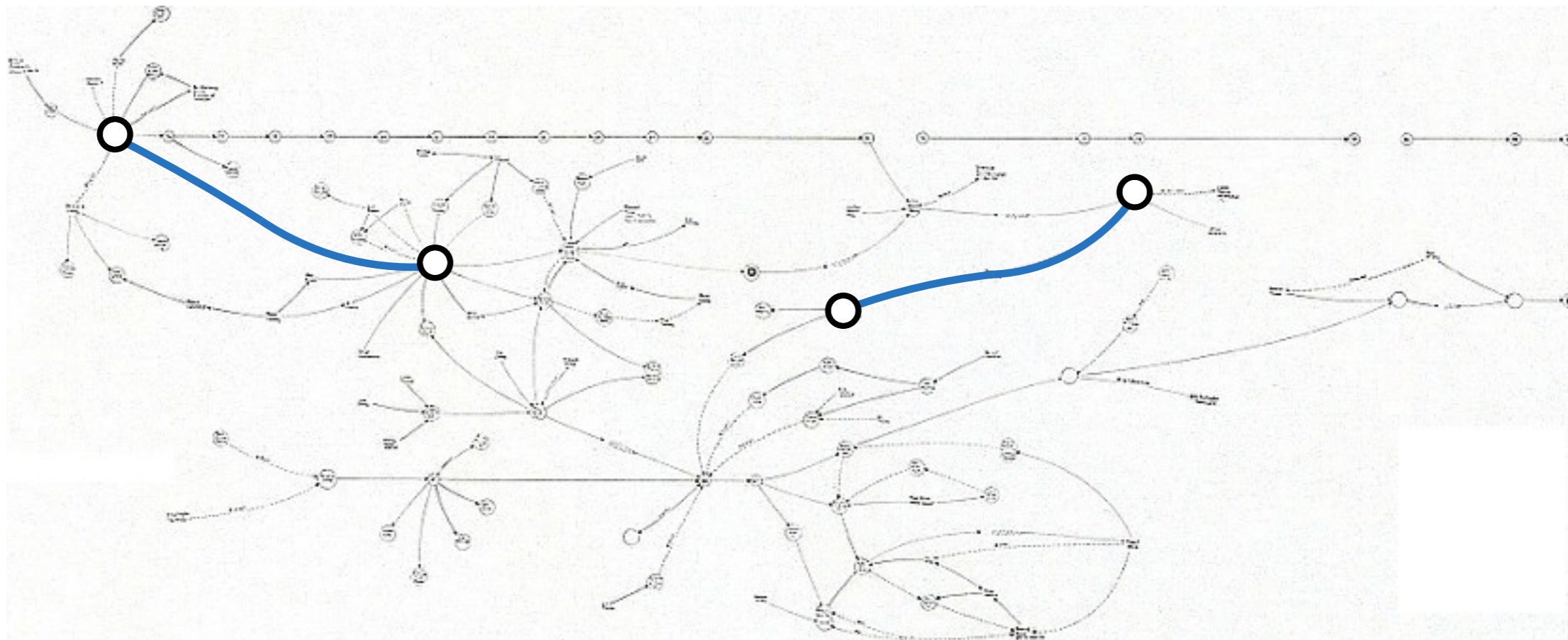
How can we draw graphs
without Lombardi drawings?

Relax single circular arc
requirement?

PRESENT LOMBARDI DRAWINGS



PRESENT LOMBARDI DRAWINGS



PRESENT LOMBARDI DRAWINGS

How can we draw graphs
without Lombardi drawings?

Relax single circular arc
requirement?

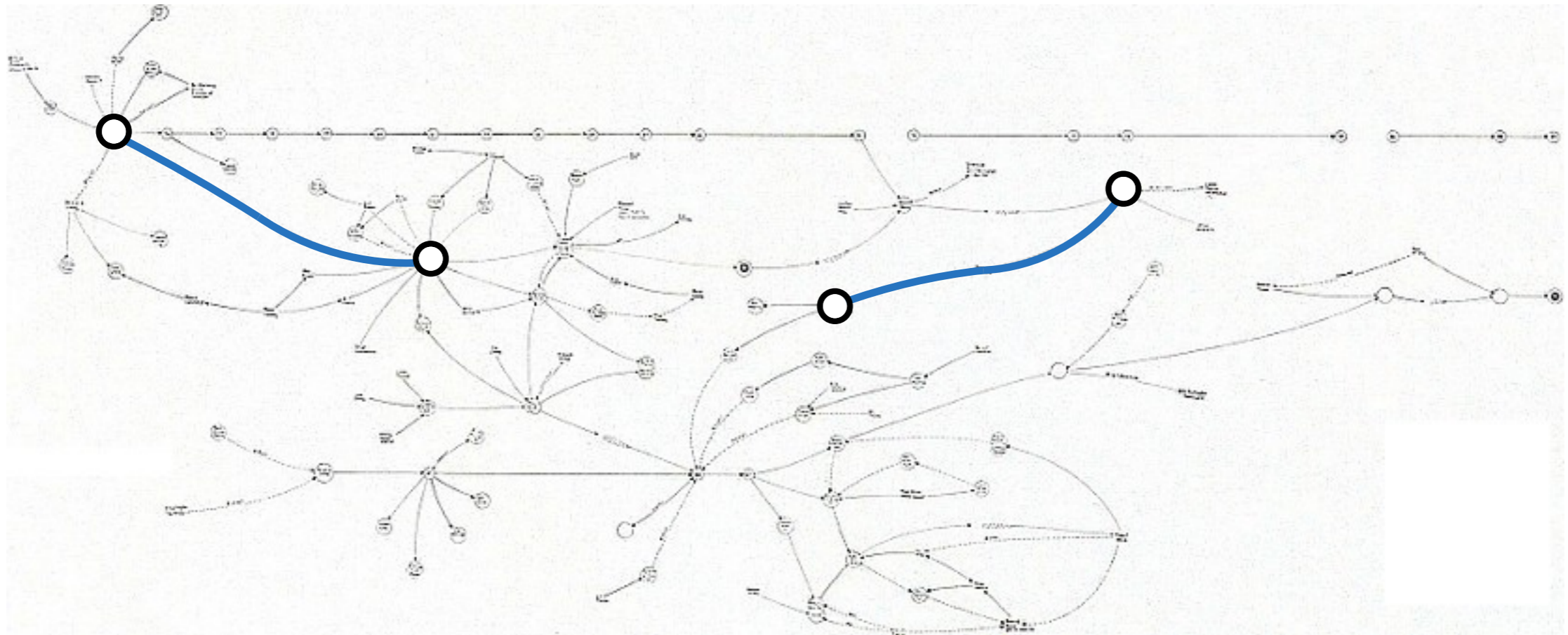
PRESENT LOMBARDI DRAWINGS

How can we draw graphs without Lombardi drawings?

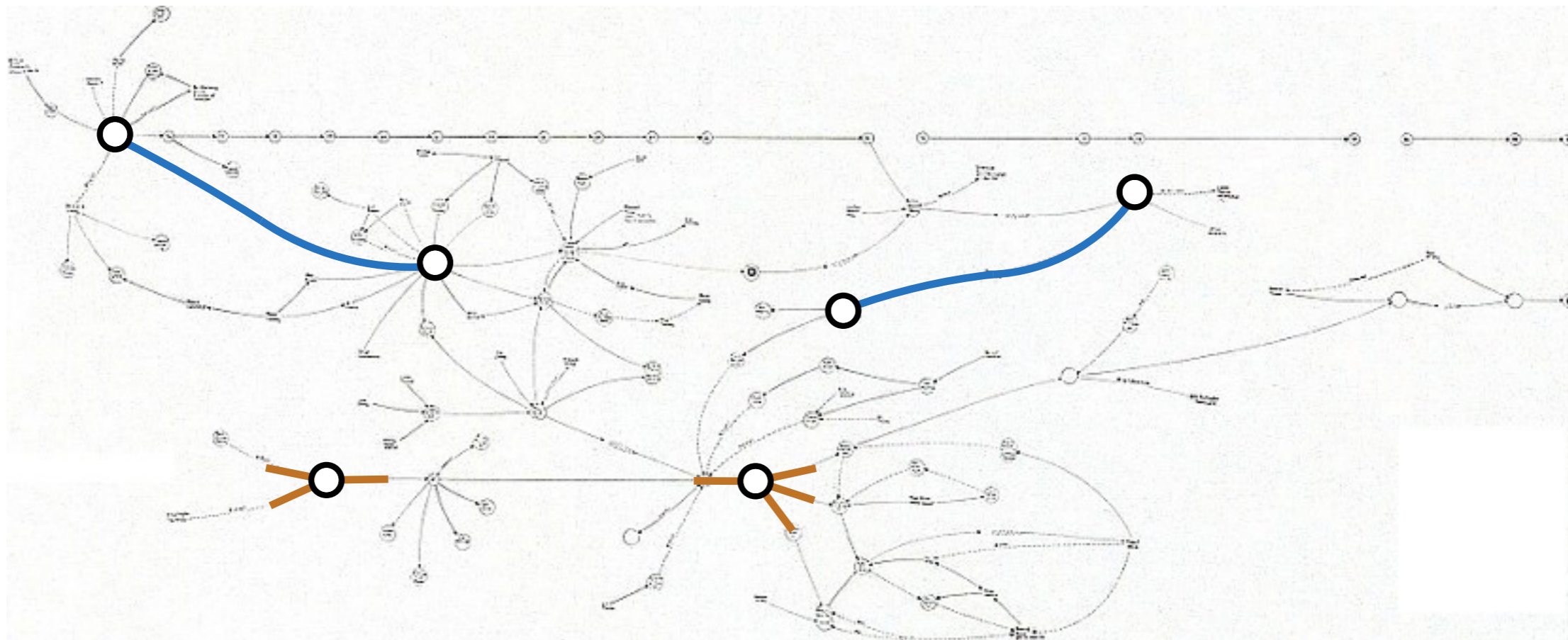
Relax single circular arc requirement?

Relax perfect angular resolution requirement?

PRESENT LOMBARDI DRAWINGS



PRESENT LOMBARDI DRAWINGS



PRESENT LOMBARDI DRAWINGS

How can we draw graphs without Lombardi drawings?

Relax single circular arc requirement?

Relax perfect angular resolution requirement?

PRESENT LOMBARDI DRAWINGS

How can we draw graphs without Lombardi drawings?

Relax single circular arc requirement?

This talk!

Relax perfect angular resolution requirement?

PRESENT LOMBARDI DRAWINGS

How can we draw graphs without Lombardi drawings?

Relax single circular arc requirement?

This talk!

Relax perfect angular resolution requirement?

Next talk!

PRESENT K-LOMBARDI DRAWINGS

GRAPH DRAWING 2011, EINDHOVEN

MAARTEN LÖFFLER

STEPHEN KOBOUROV

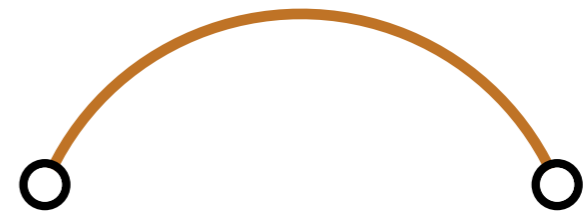
MICHAEL GOODRICH

PRESENT K-L LOMBARDI DRAWINGS

Def: *Lombardi edge*
Single circular arc.

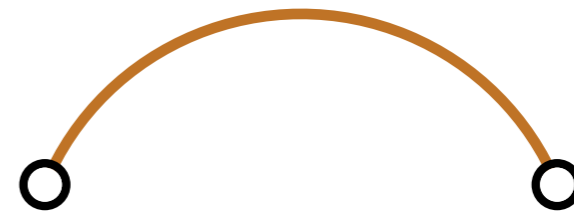
PRESENT K-L LOMBARDI DRAWINGS

Def: *Lombardi edge*
Single circular arc.



PRESENT K-L LOMBARDI DRAWINGS

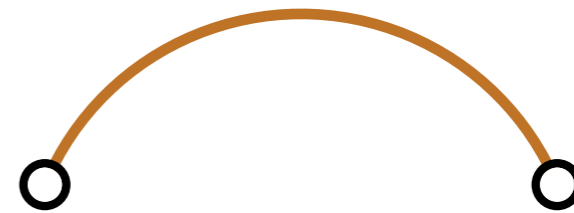
Def: *Lombardi edge*
Single circular arc.



Def: *k-Lombardi edge*
Sequence of k circular arcs.

PRESENT K-L LOMBARDI DRAWINGS

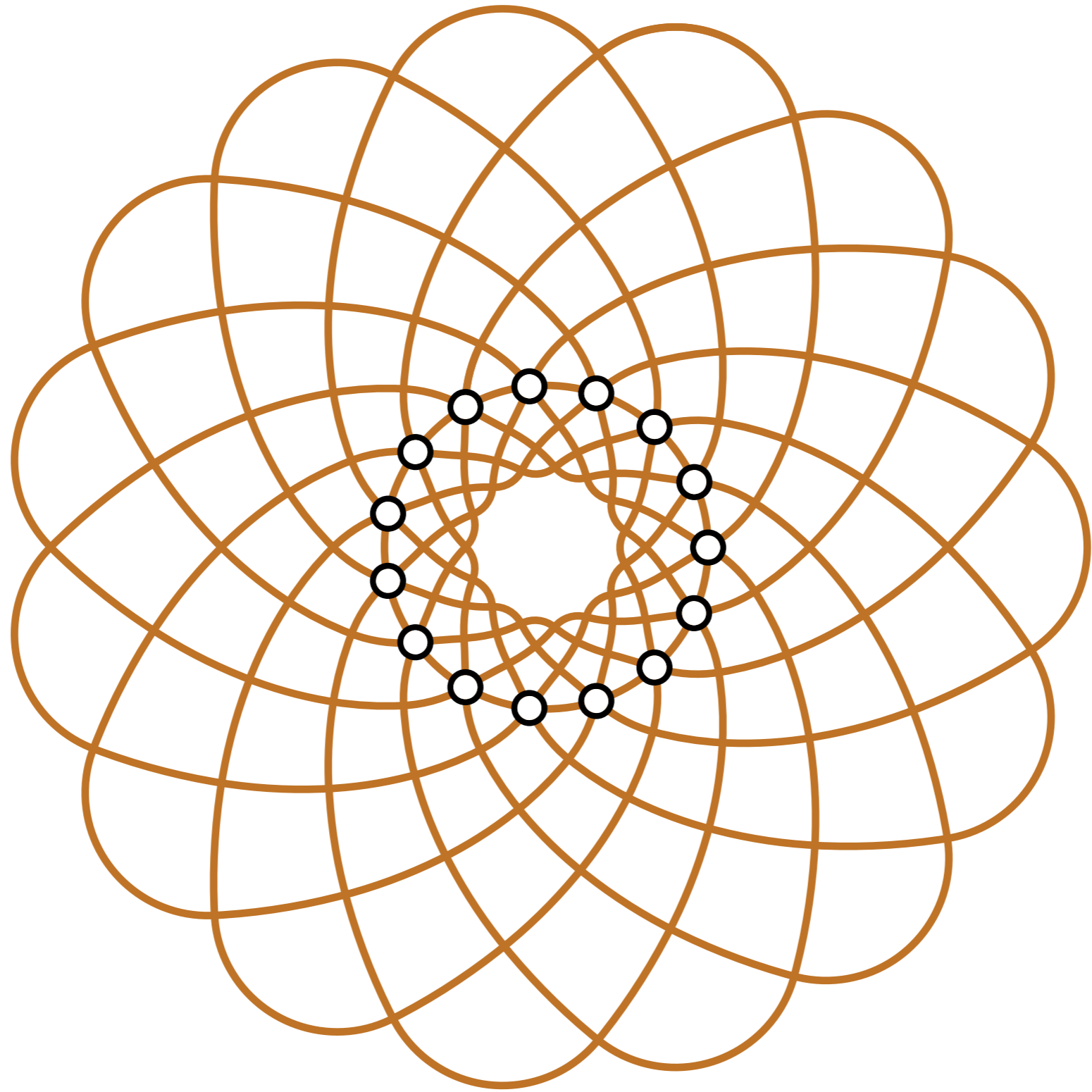
Def: *Lombardi edge*
Single circular arc.



Def: *k-Lombardi edge*
Sequence of k circular arcs.



PRESENT K-LOMBARDI DRAWINGS



GRAPH DRAWING 2011, EINDHOVEN

MAARTEN LÖFFLER

STEPHEN KOBOUROV

PRESENT NEW RESULTS

PRESENT NEW RESULTS

Theorem: Not every graph has a 1-Lombardi drawing.

PRESENT NEW RESULTS

Theorem: Not every graph has a 1-Lombardi drawing.

Theorem: Every graph has a 2-Lombardi drawing.

PRESENT NEW RESULTS

Theorem: Not every planar 3-degenerate graph has a planar 1-Lombardi drawing.

PRESENT NEW RESULTS

Theorem: Not every planar 3-degenerate graph has a planar 1-Lombardi drawing.

Theorem: Every planar 3-regular graph has a planar 2-Lombardi drawing.

PRESENT NEW RESULTS

Theorem: Not every planar 3-degenerate graph has a planar 1-Lombardi drawing.

Theorem: Every planar 3-regular graph has a planar 2-Lombardi drawing.

Theorem: Every planar graph has a planar 3-Lombardi drawing.

PRESENT NEW RESULTS

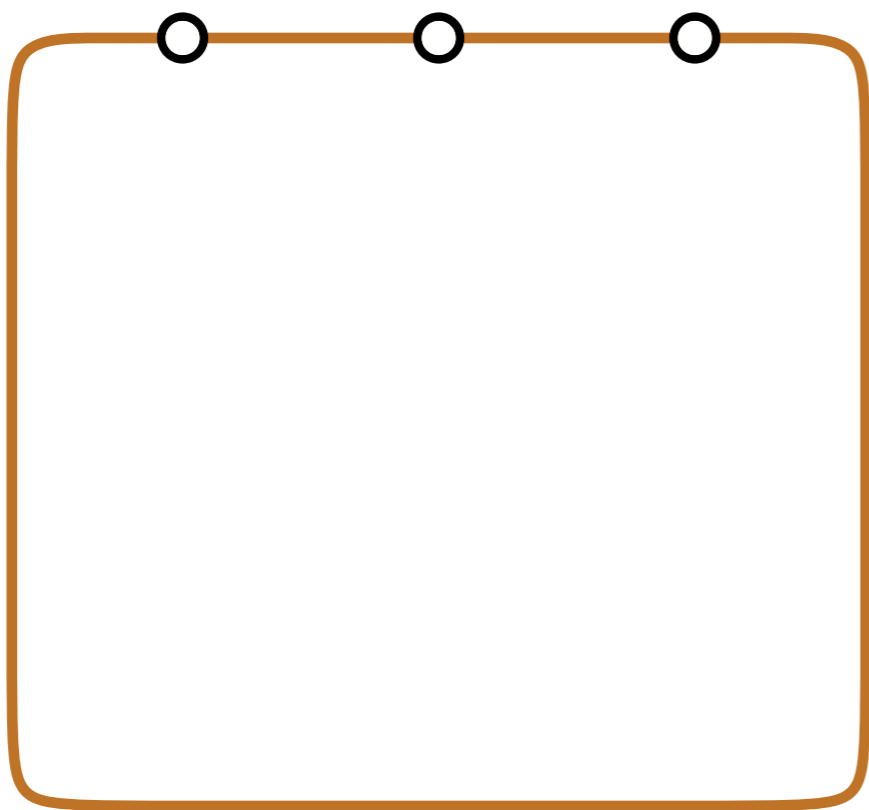
Theorem: Not every planar 3-degenerate graph has a planar 1-Lombardi drawing.

Theorem: Every planar 3-regular graph has a planar 2-Lombardi drawing.

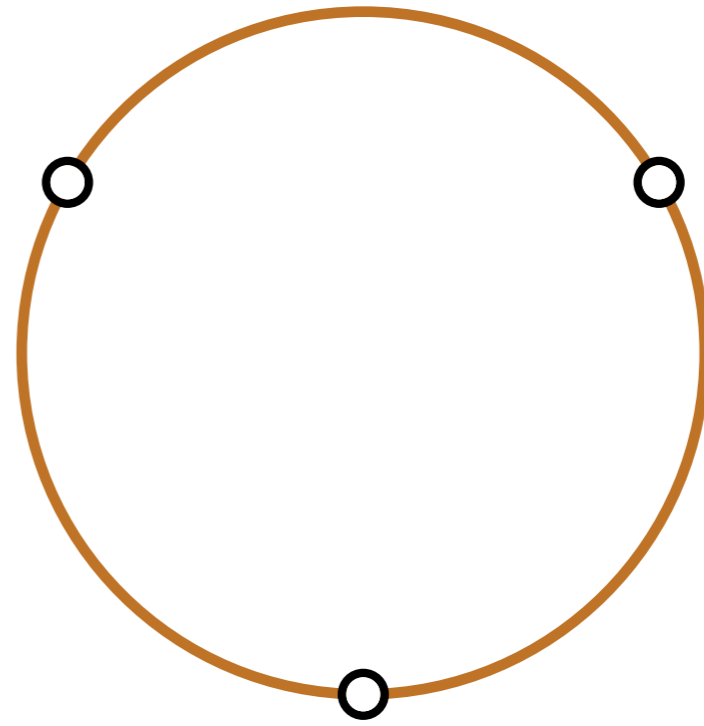
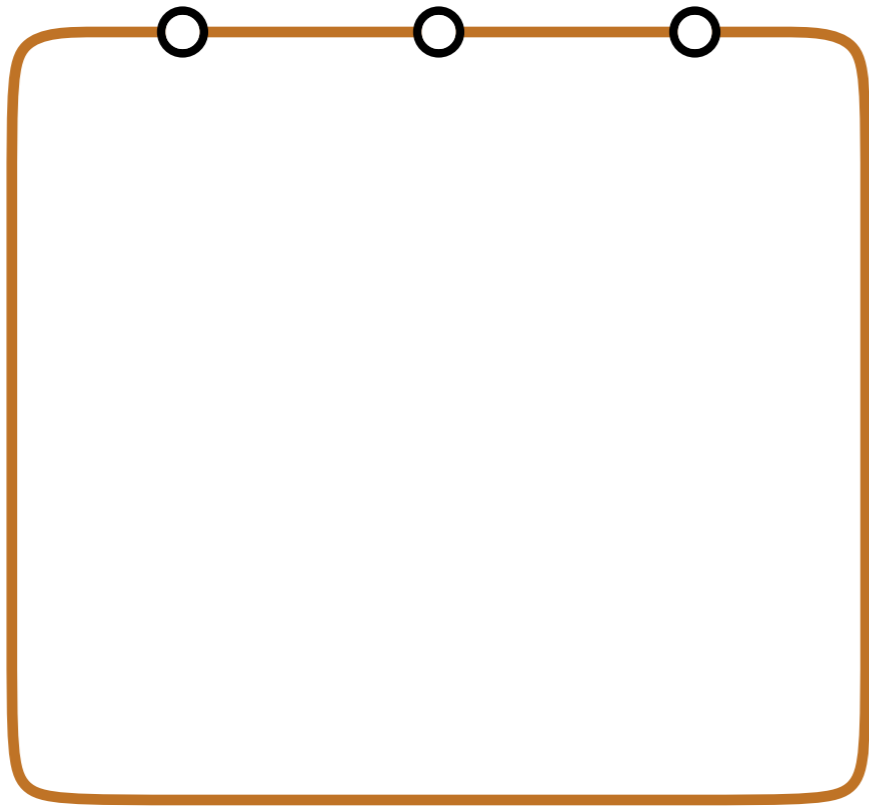
Theorem: Every planar graph has a planar 3-Lombardi drawing.

PRESENT A NEGATIVE RESULT

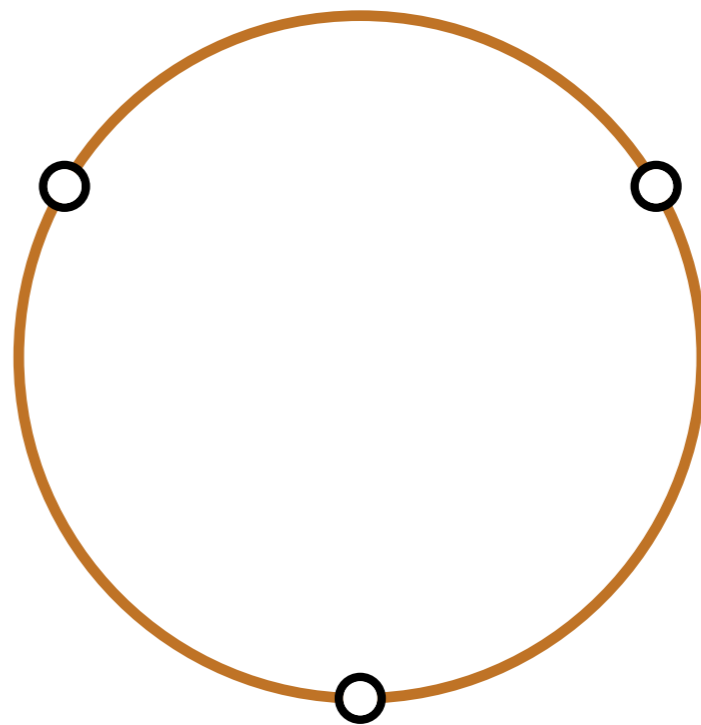
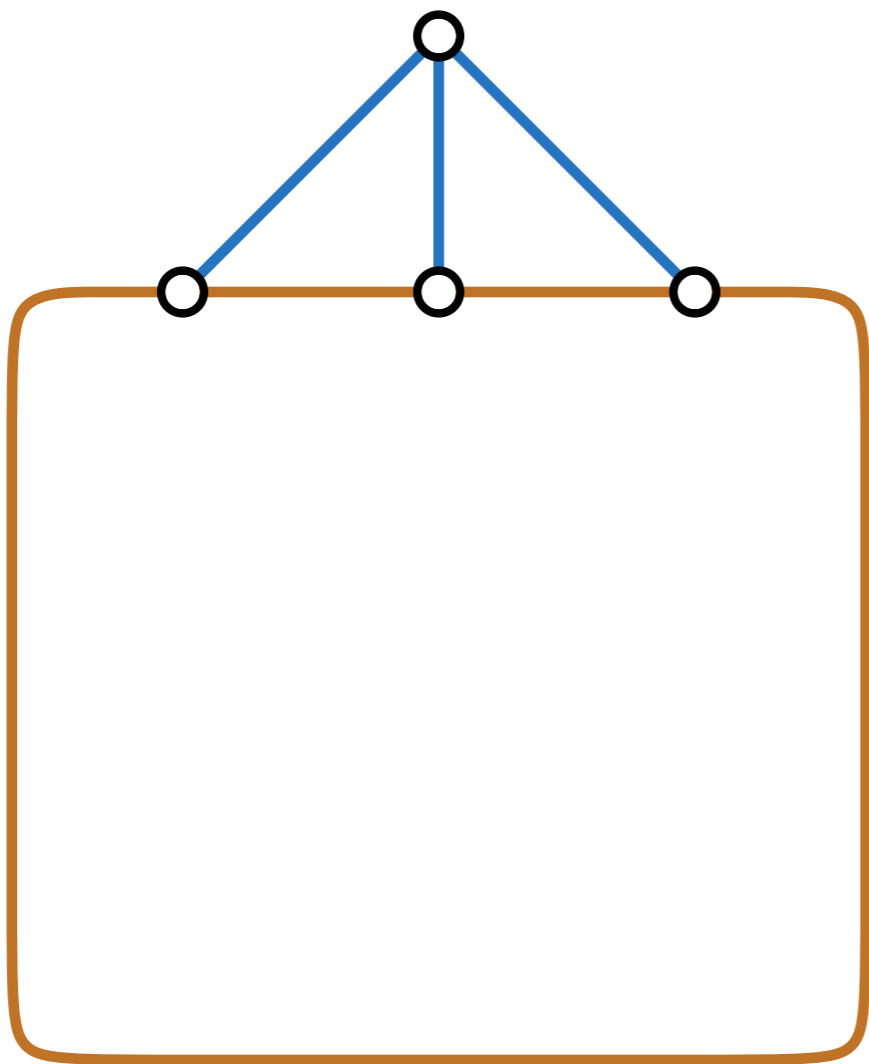
PRESENT A NEGATIVE RESULT



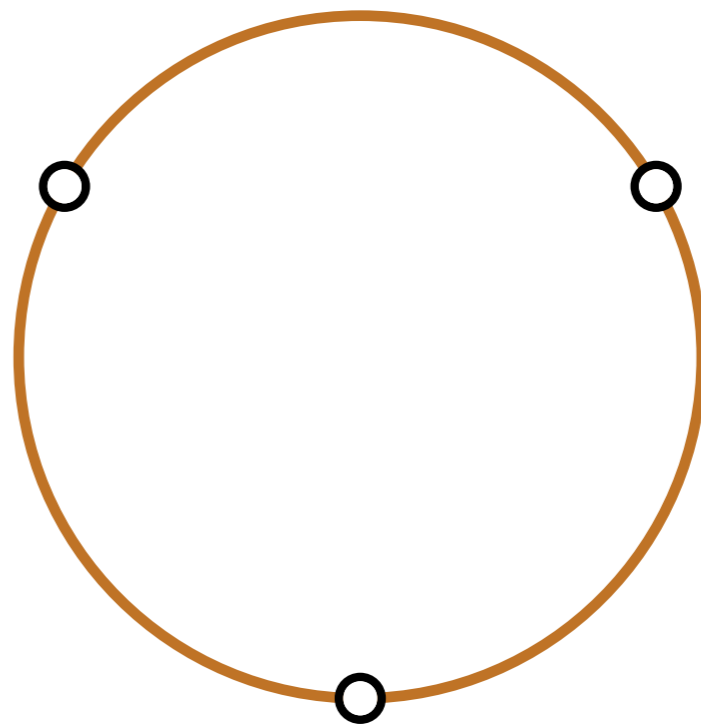
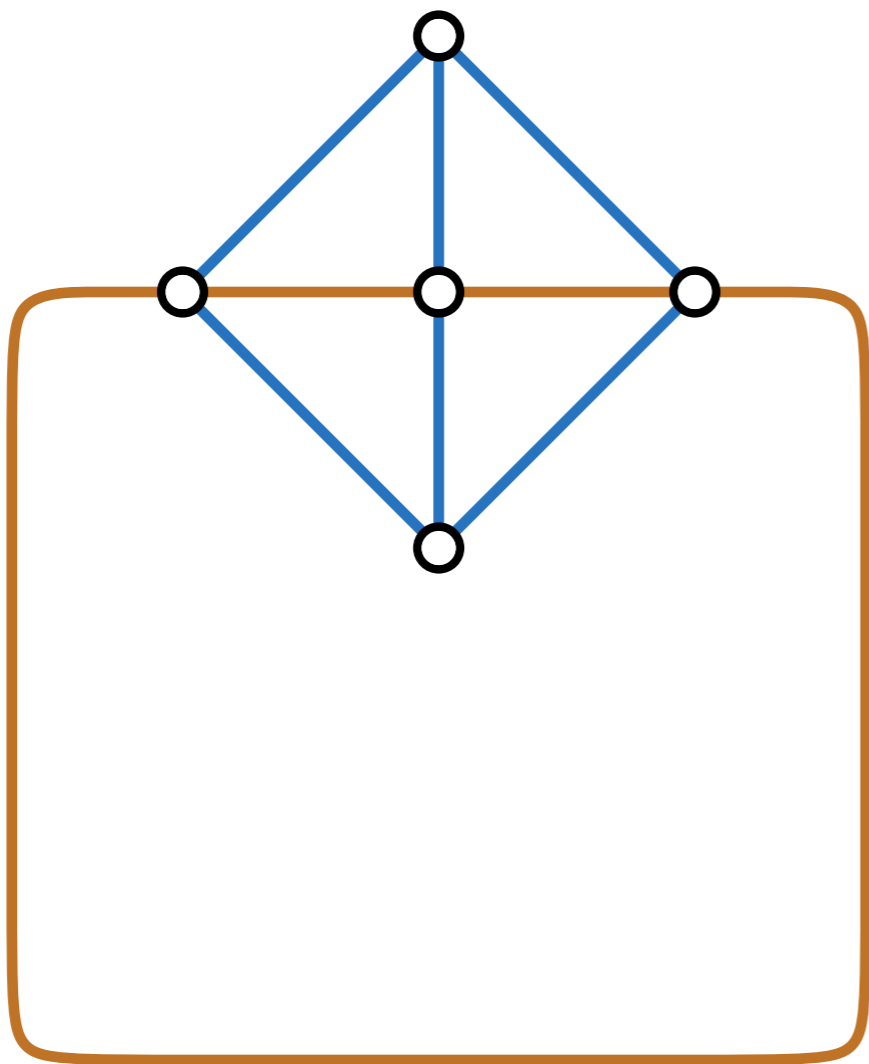
PRESENT A NEGATIVE RESULT



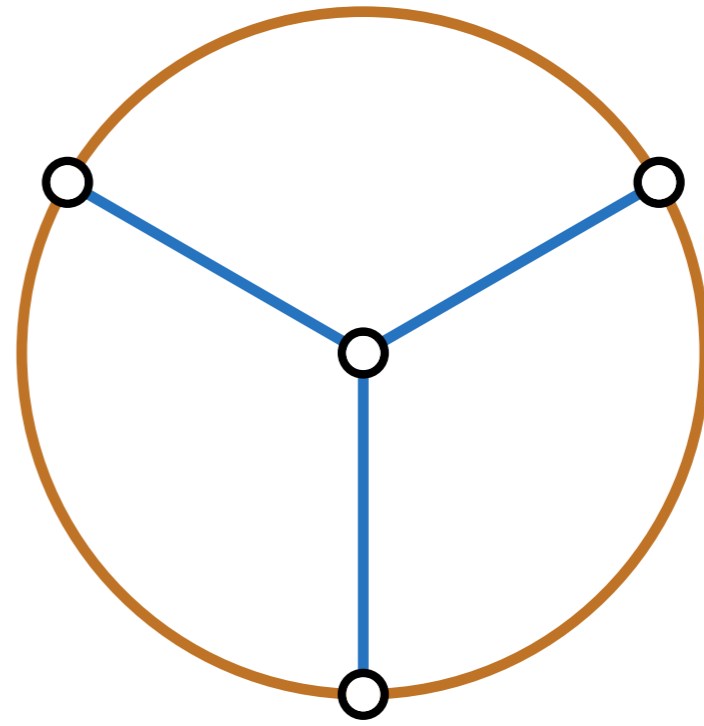
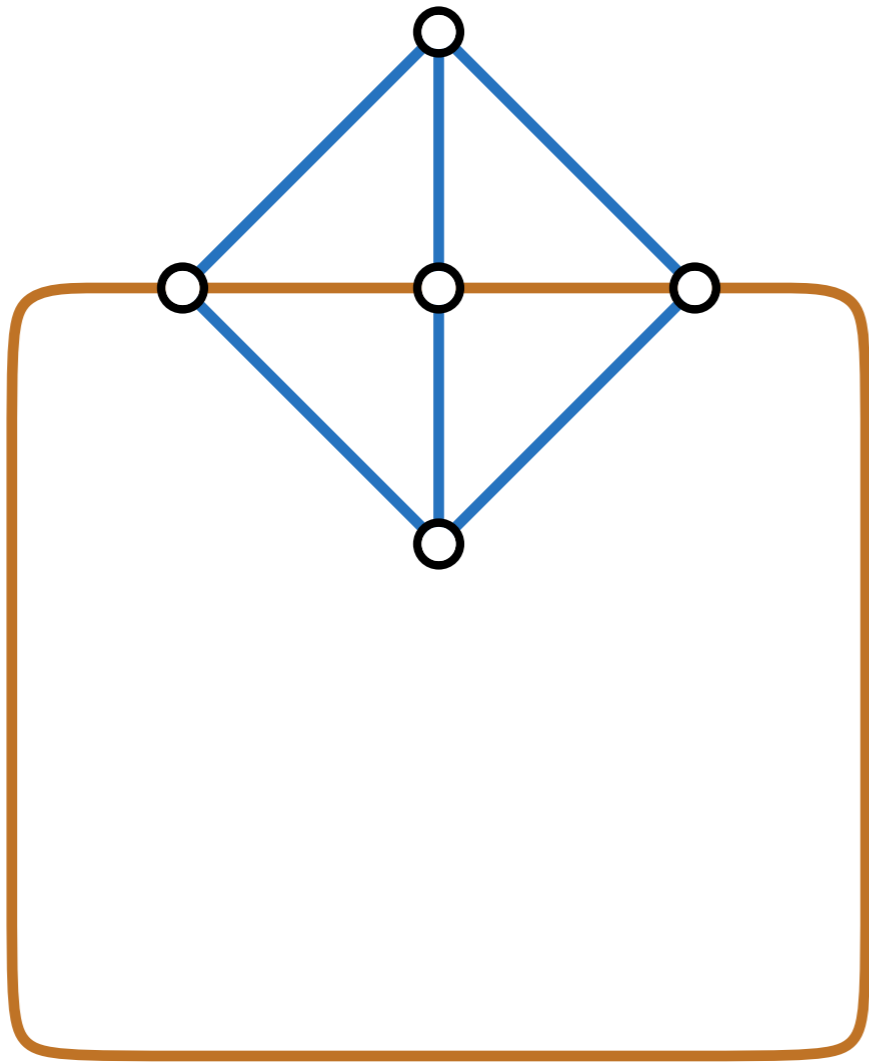
PRESENT A NEGATIVE RESULT



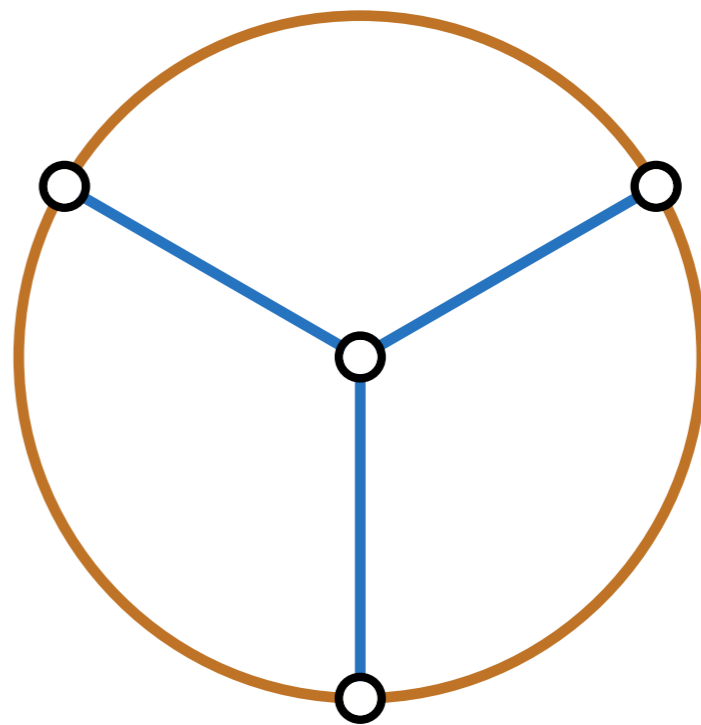
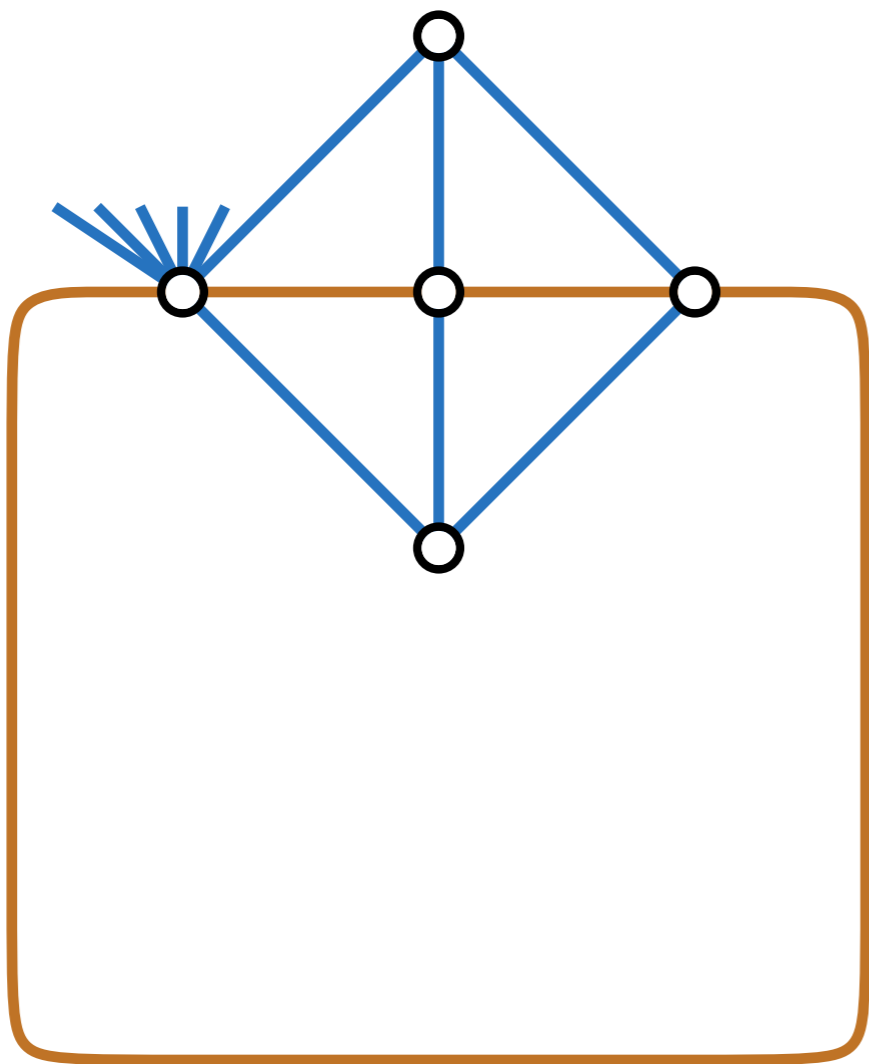
PRESENT A NEGATIVE RESULT



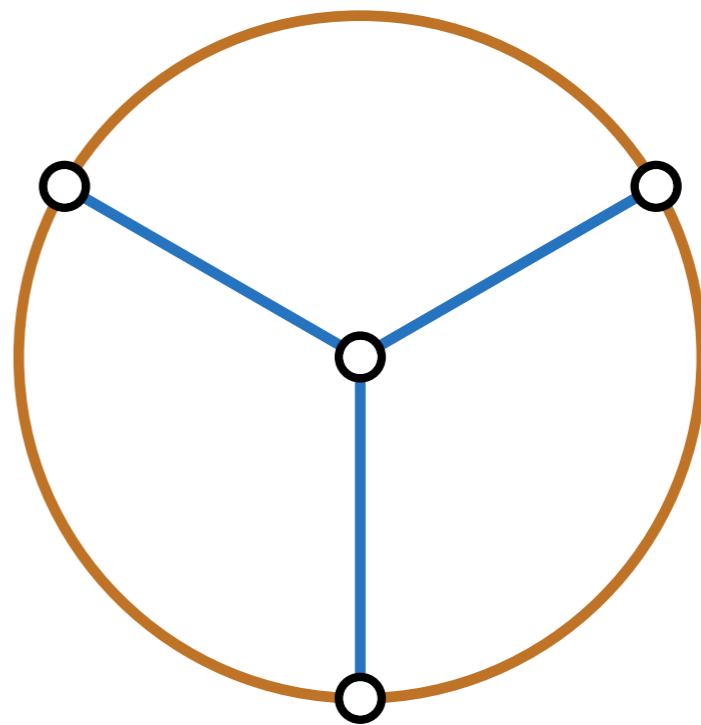
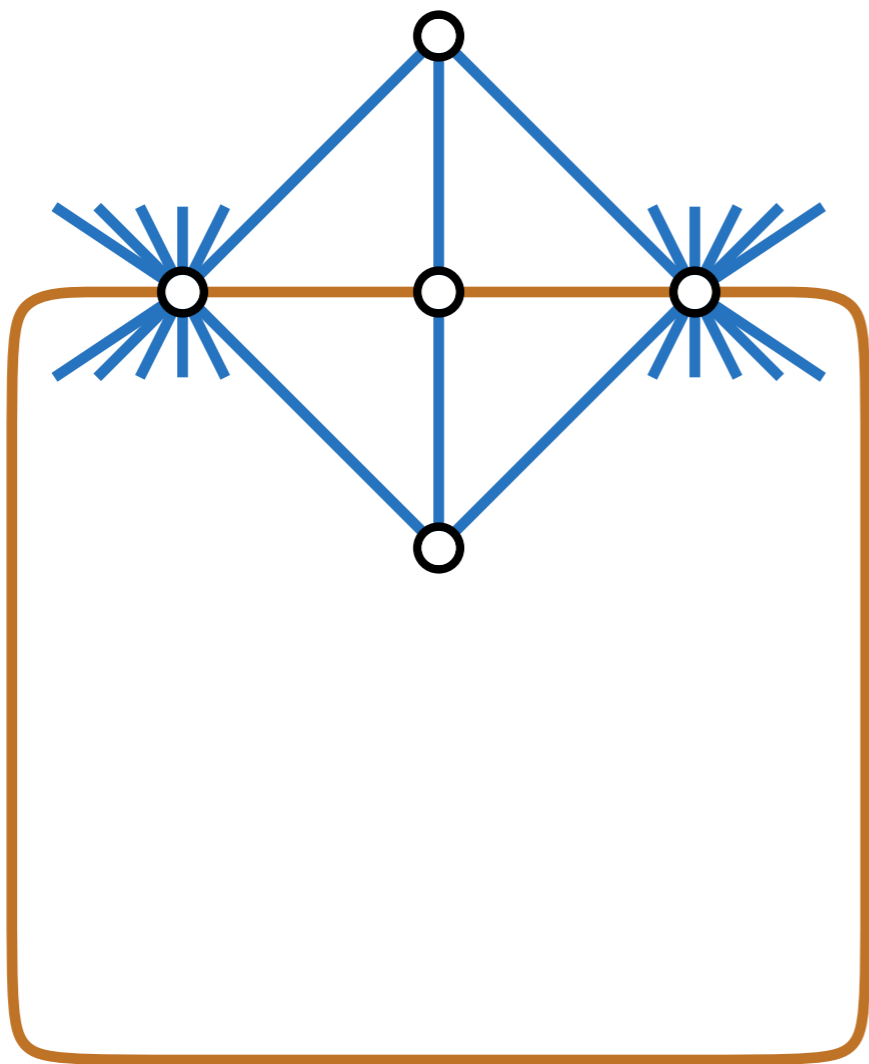
PRESENT A NEGATIVE RESULT



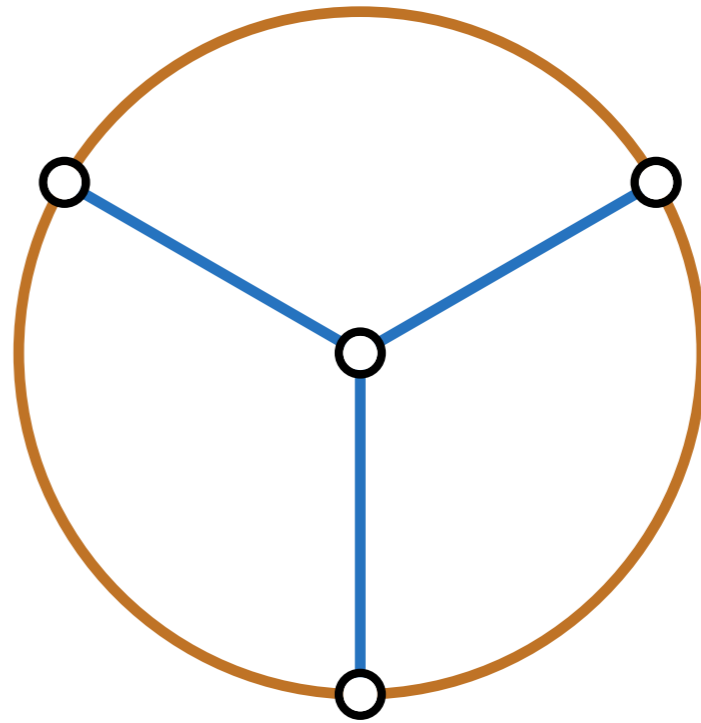
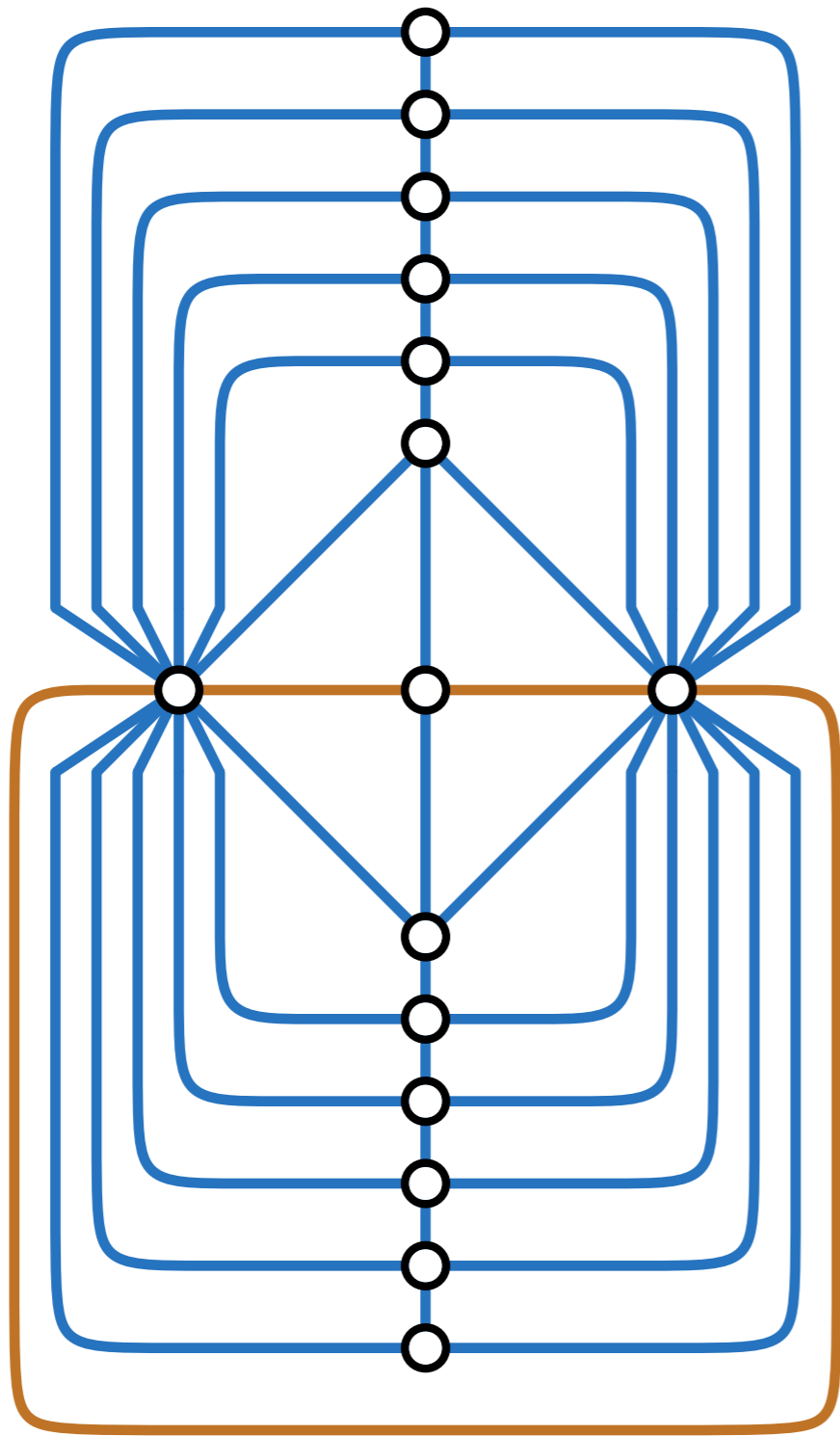
PRESENT A NEGATIVE RESULT



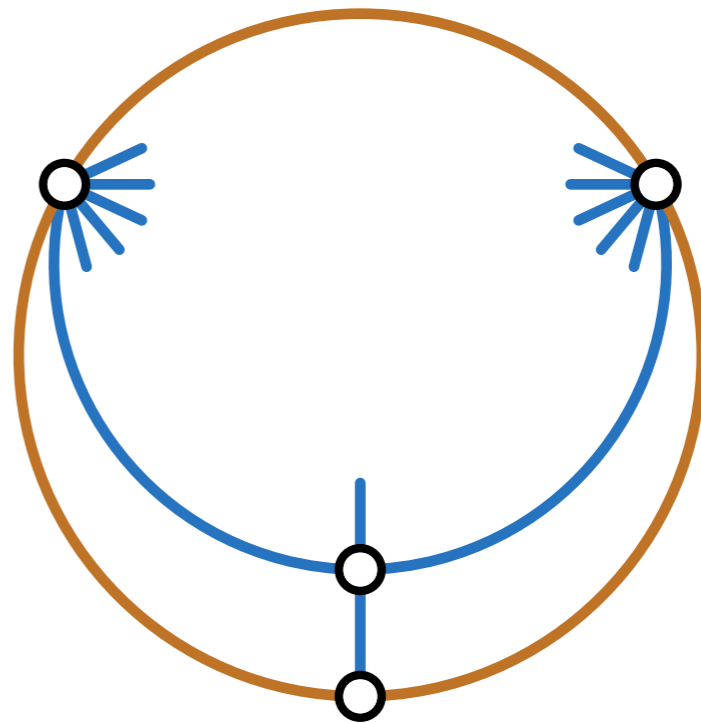
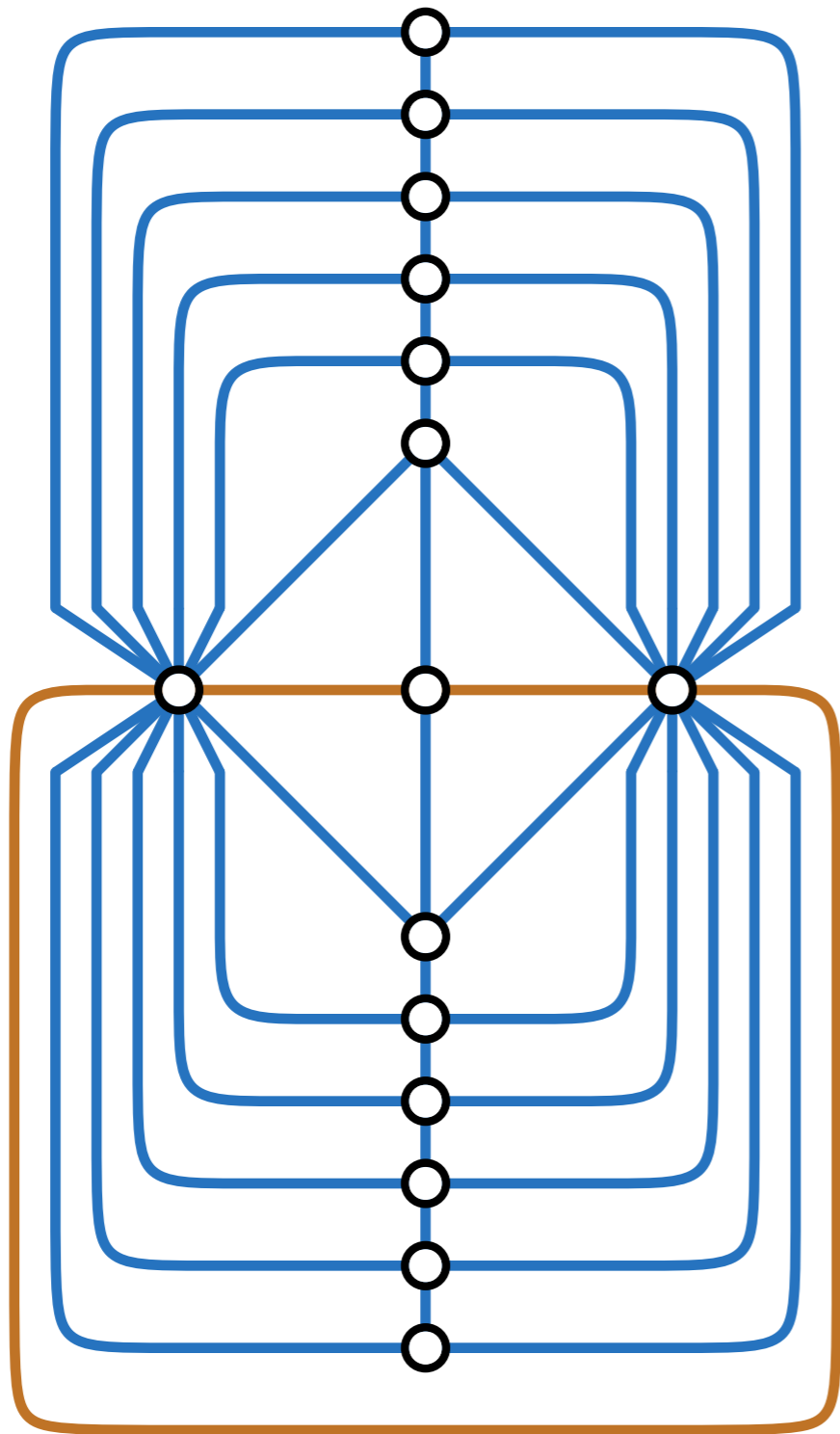
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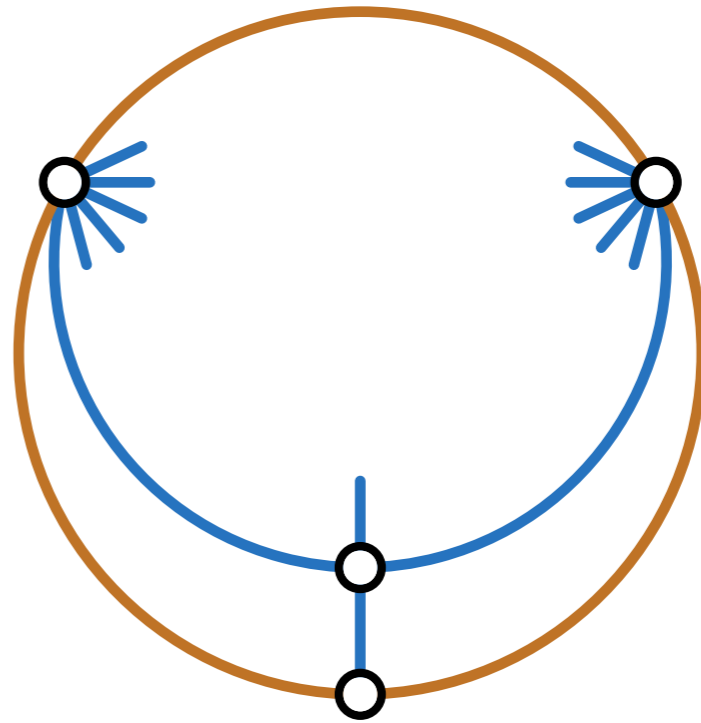
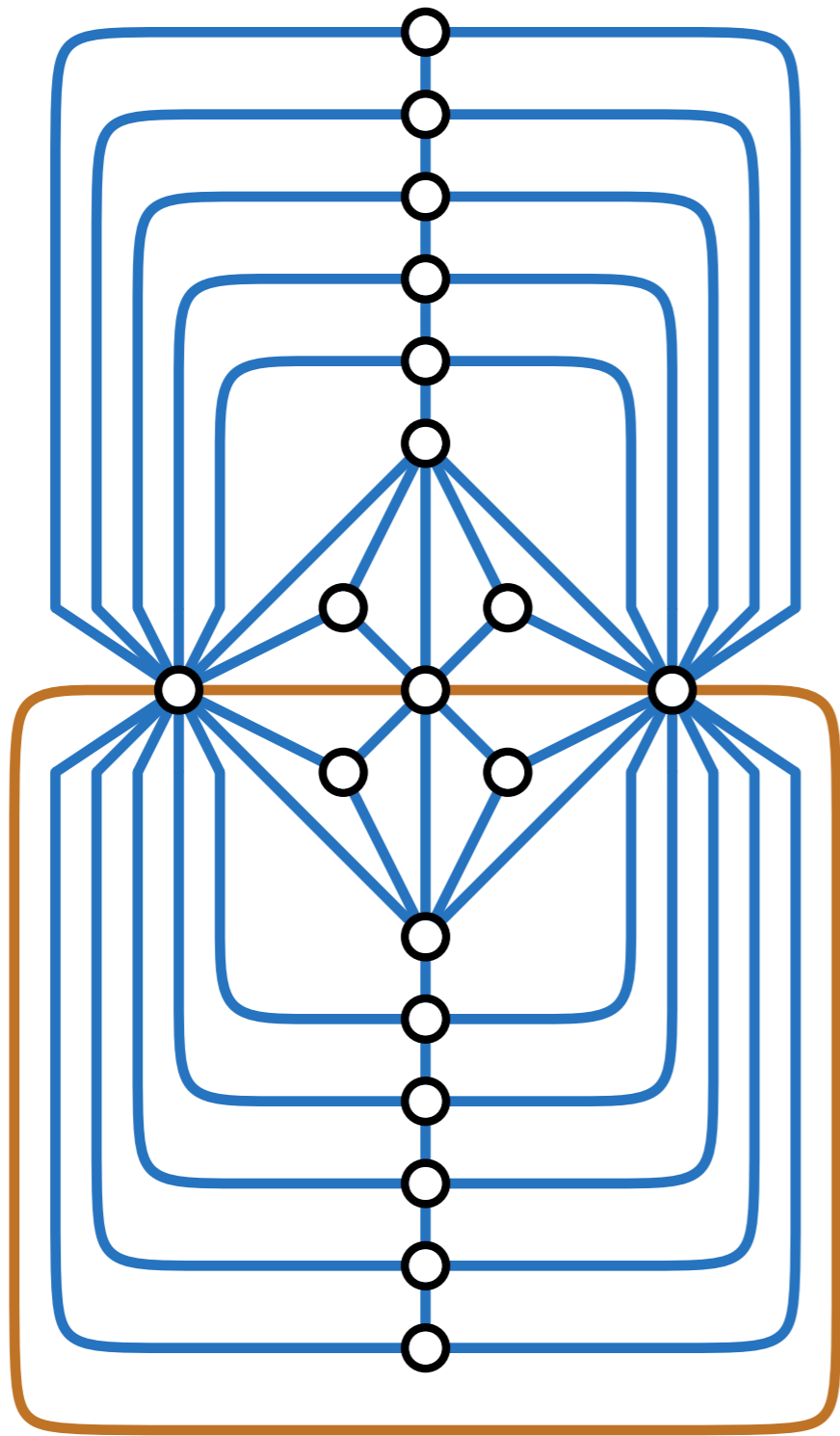
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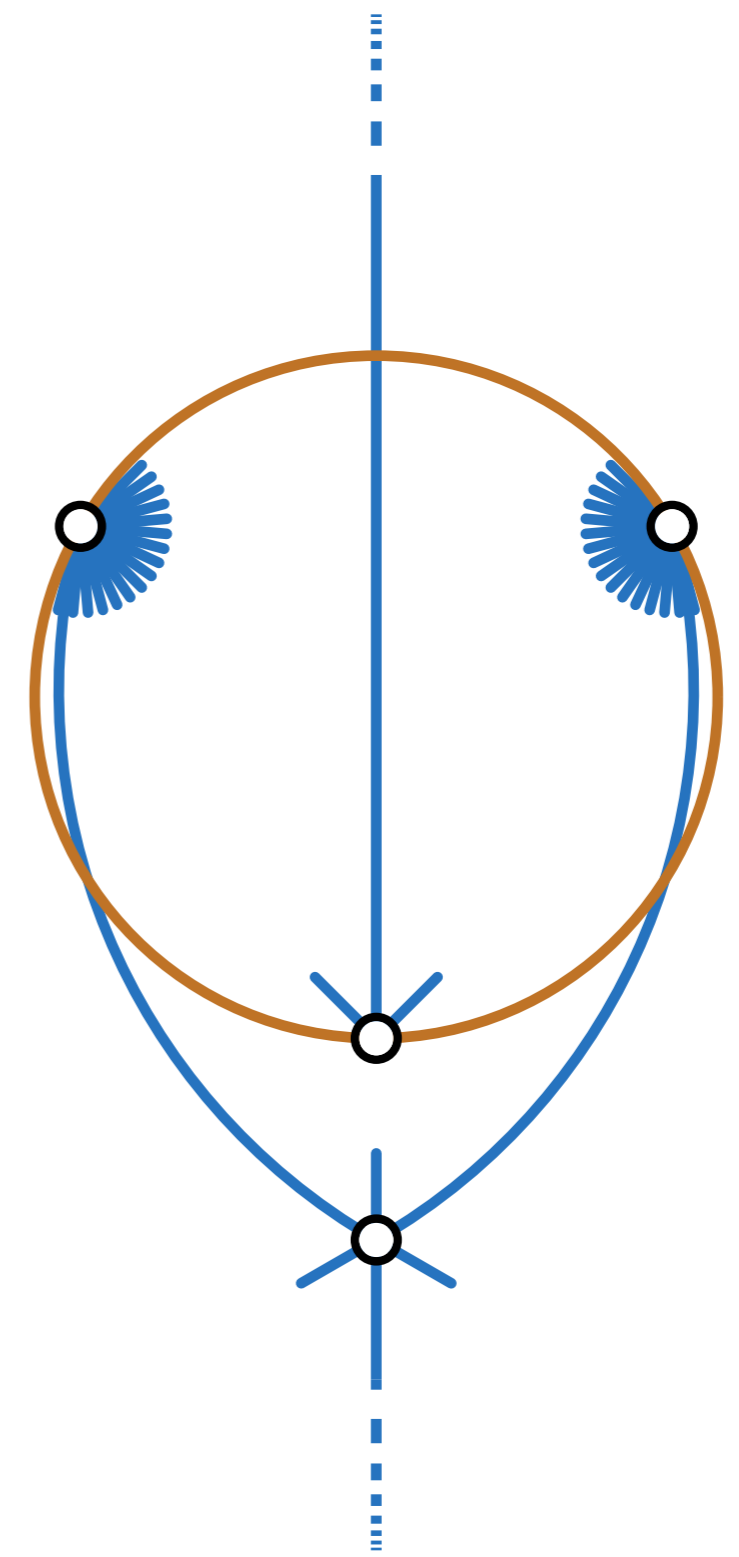
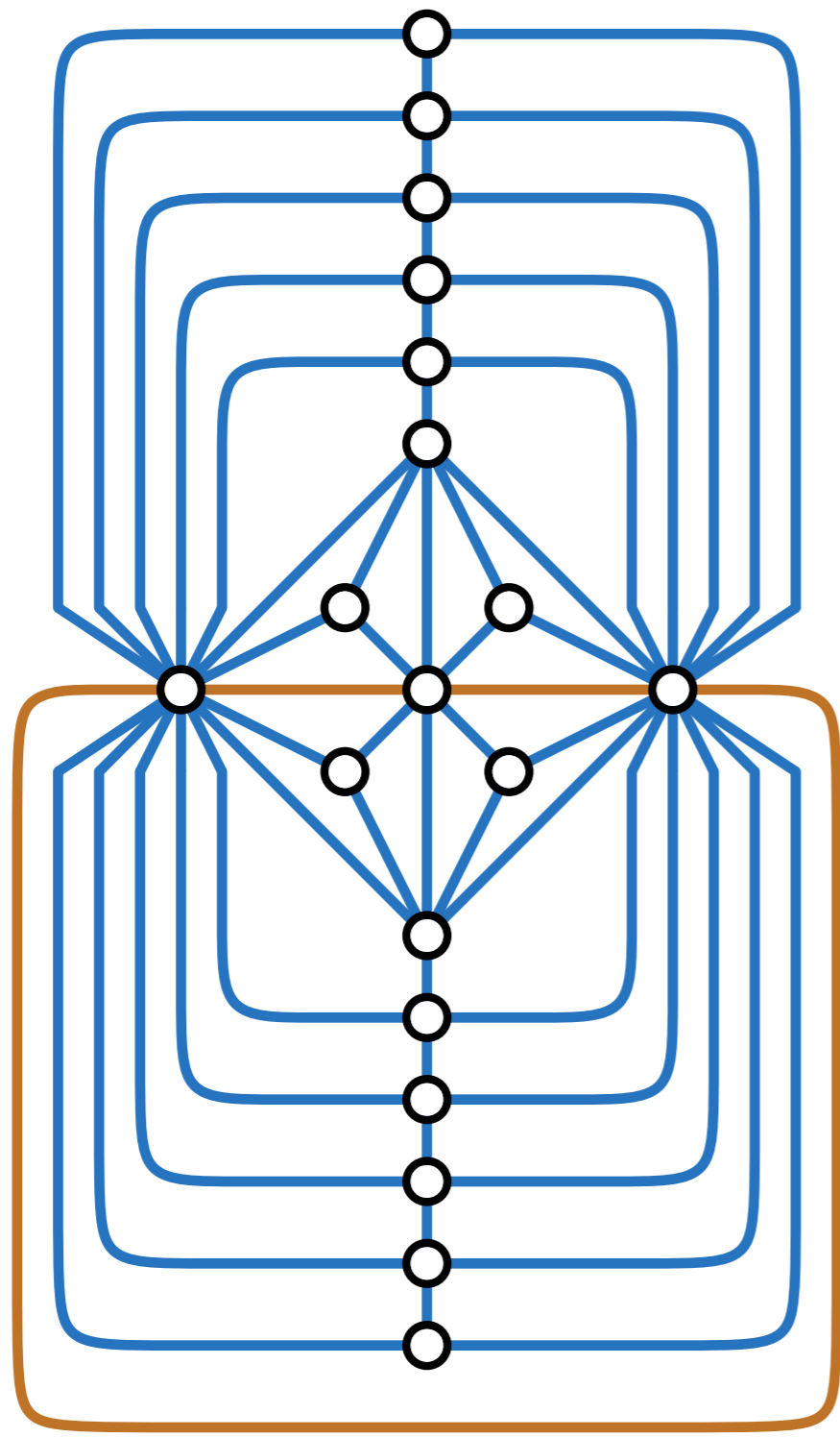
PRESENT A NEGATIVE RESULT



PRESENT A NEGATIVE RESULT

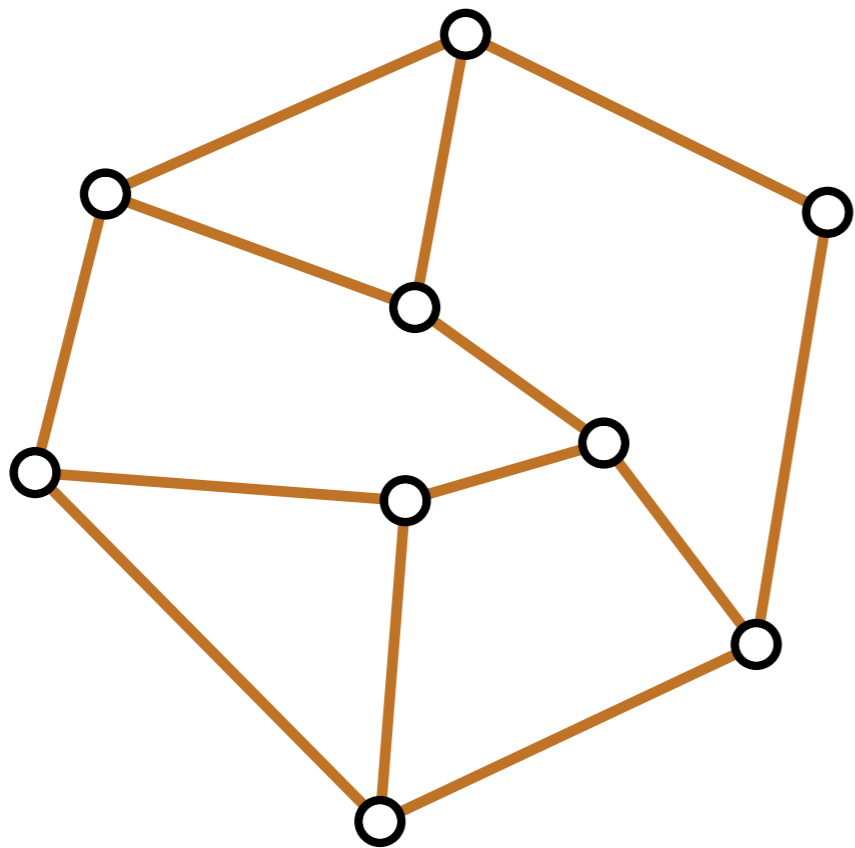


PRESENT A NEGATIVE RESULT

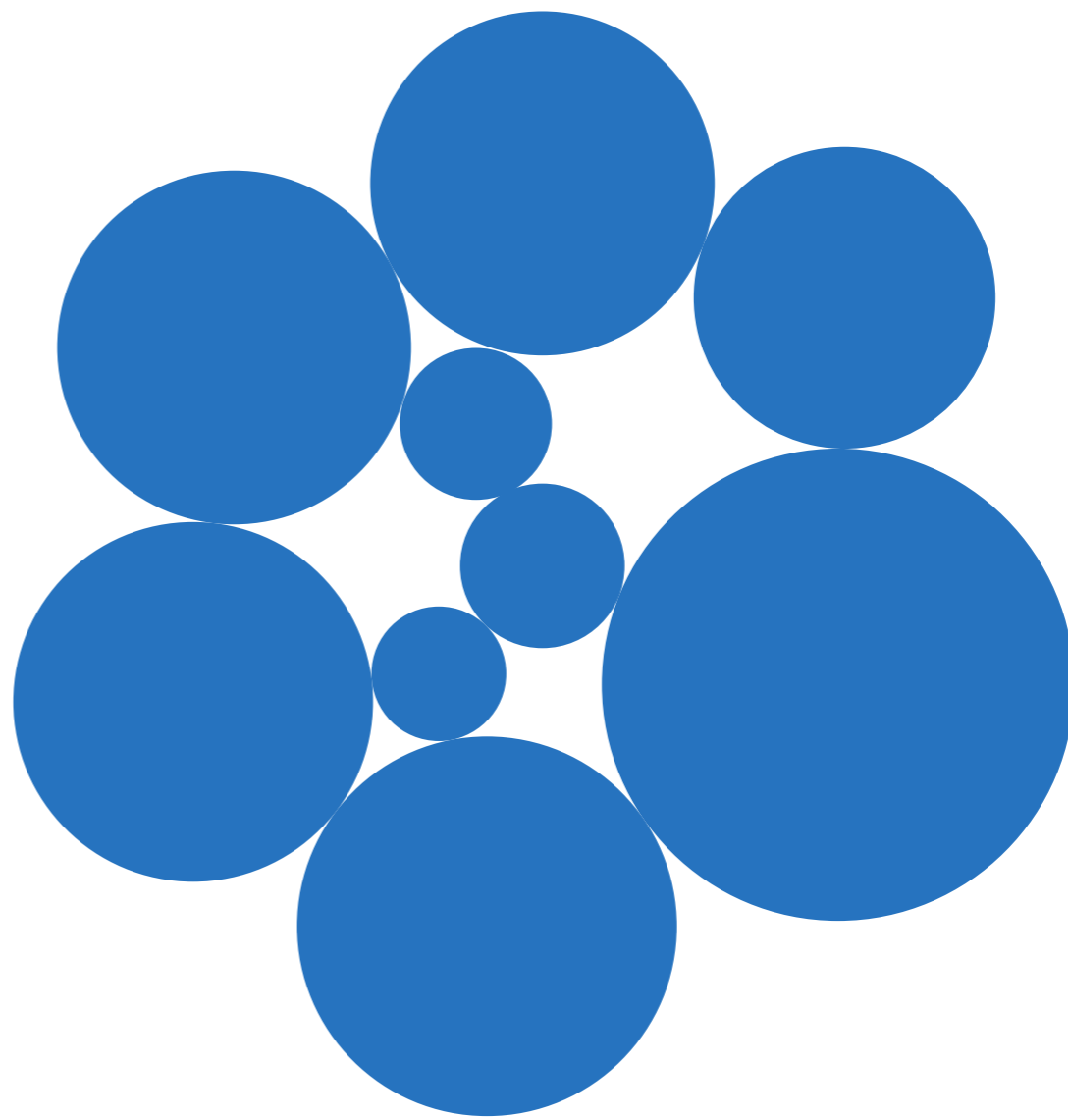
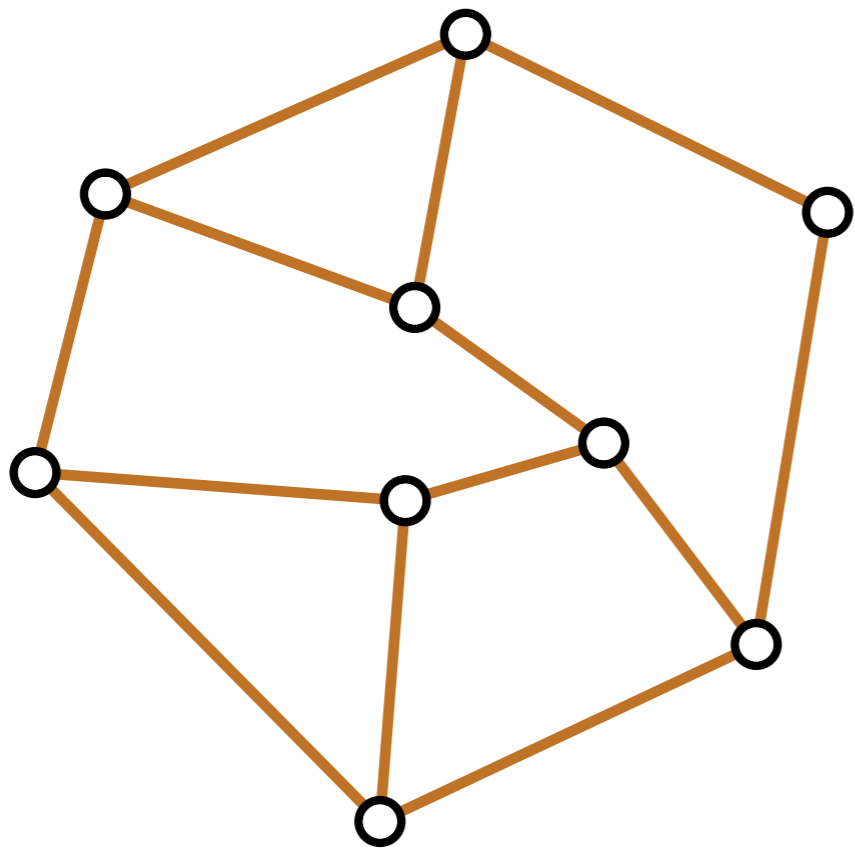


PRESENT A POSITIVE RESULT

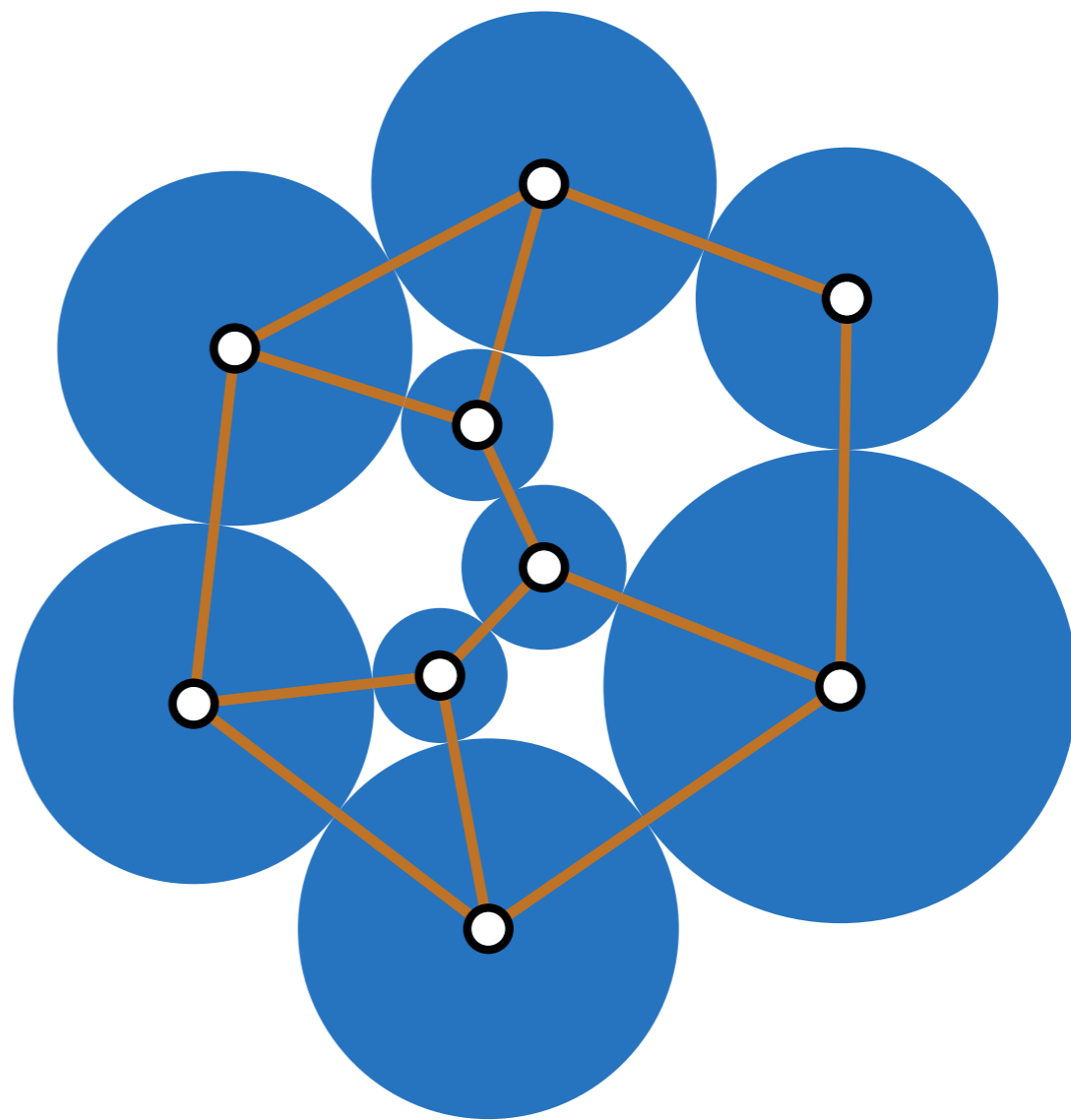
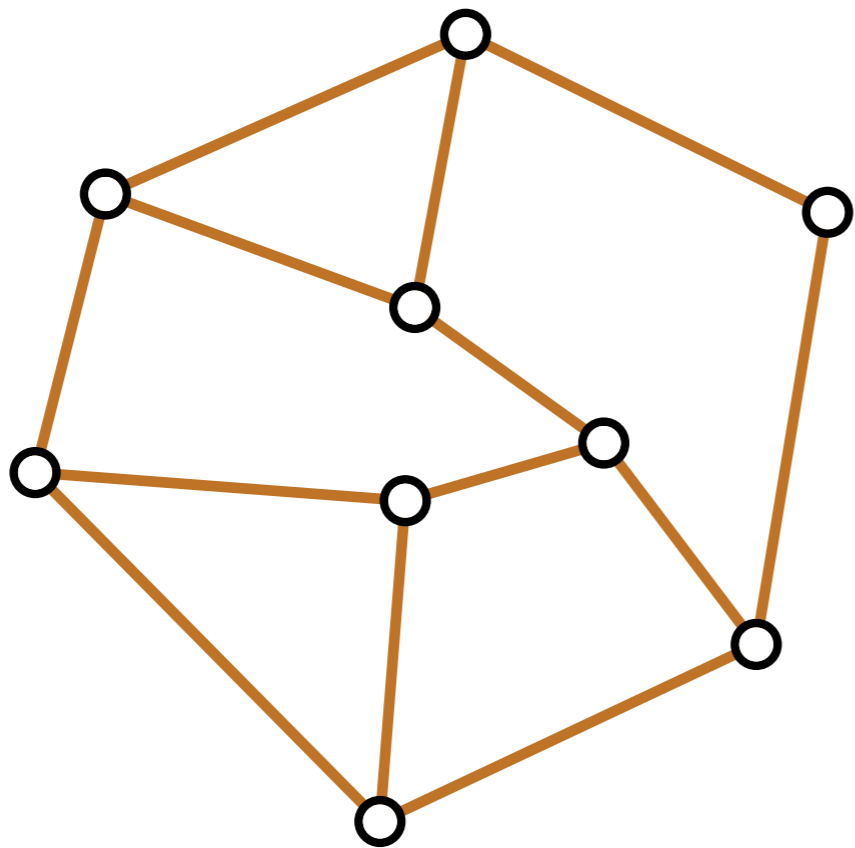
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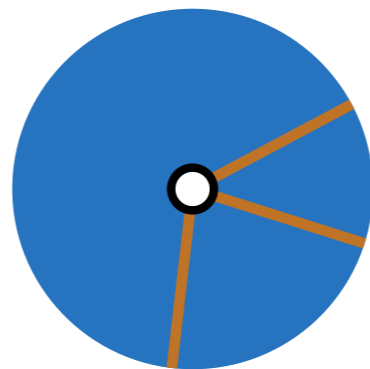
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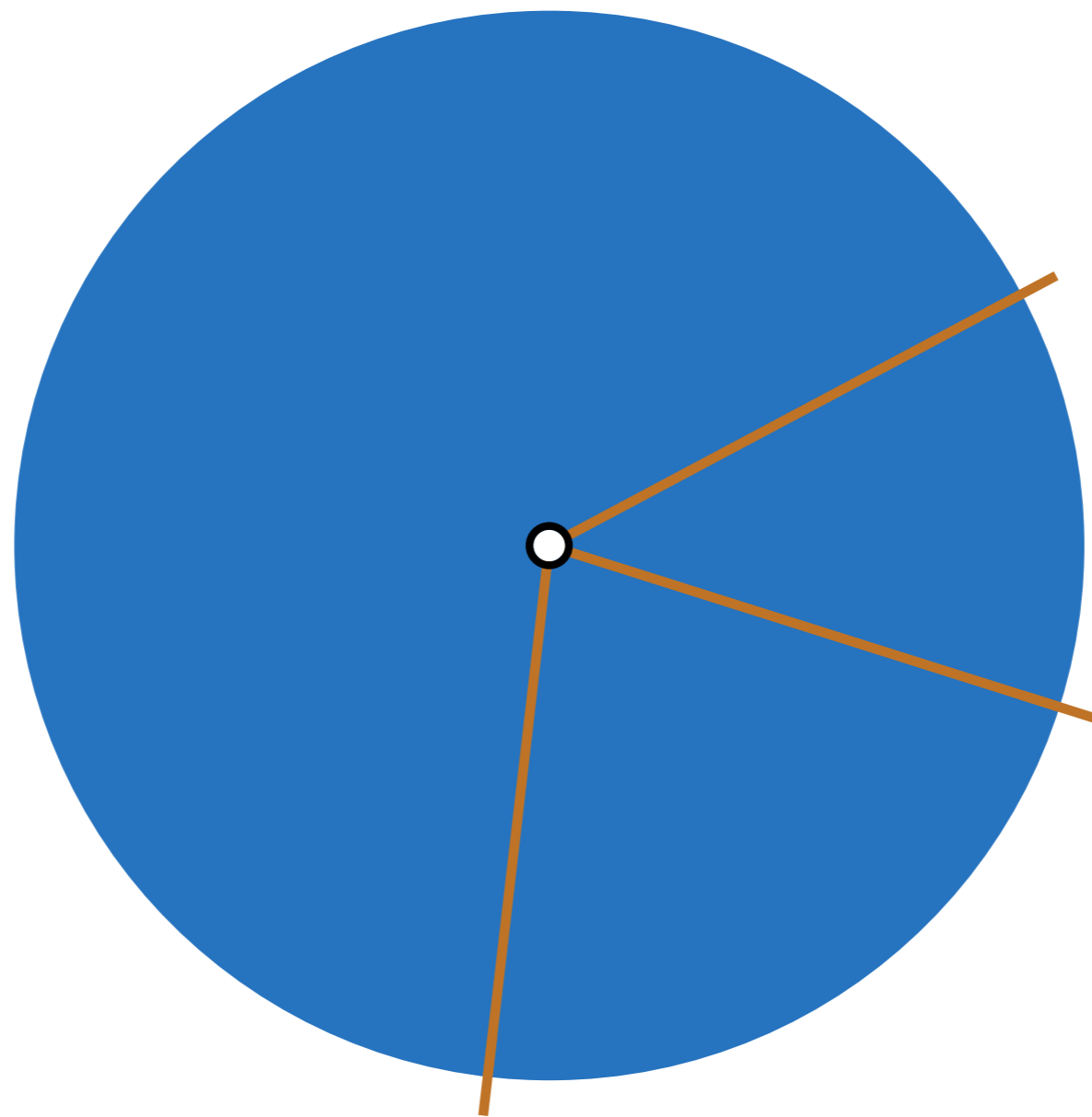
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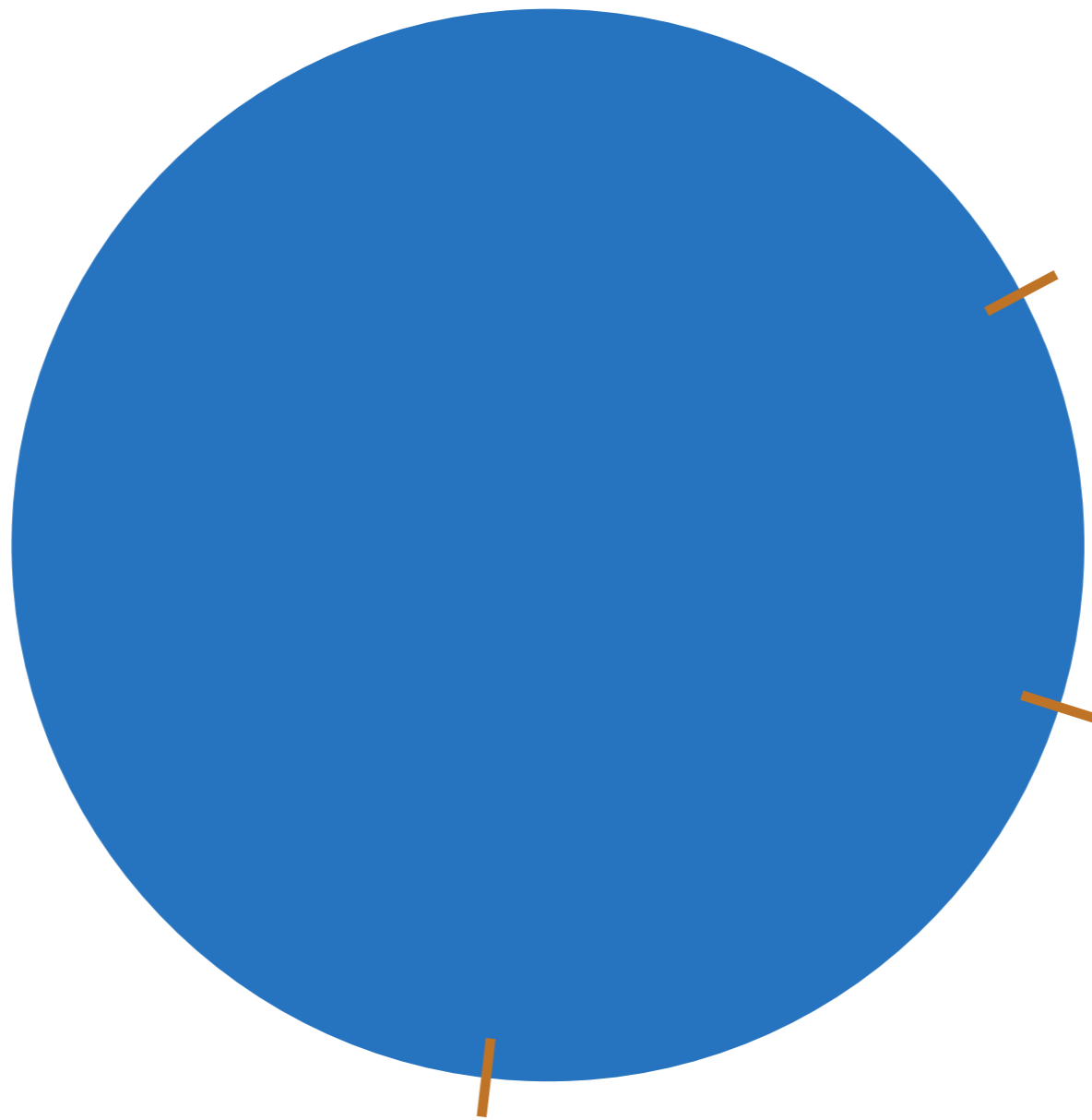
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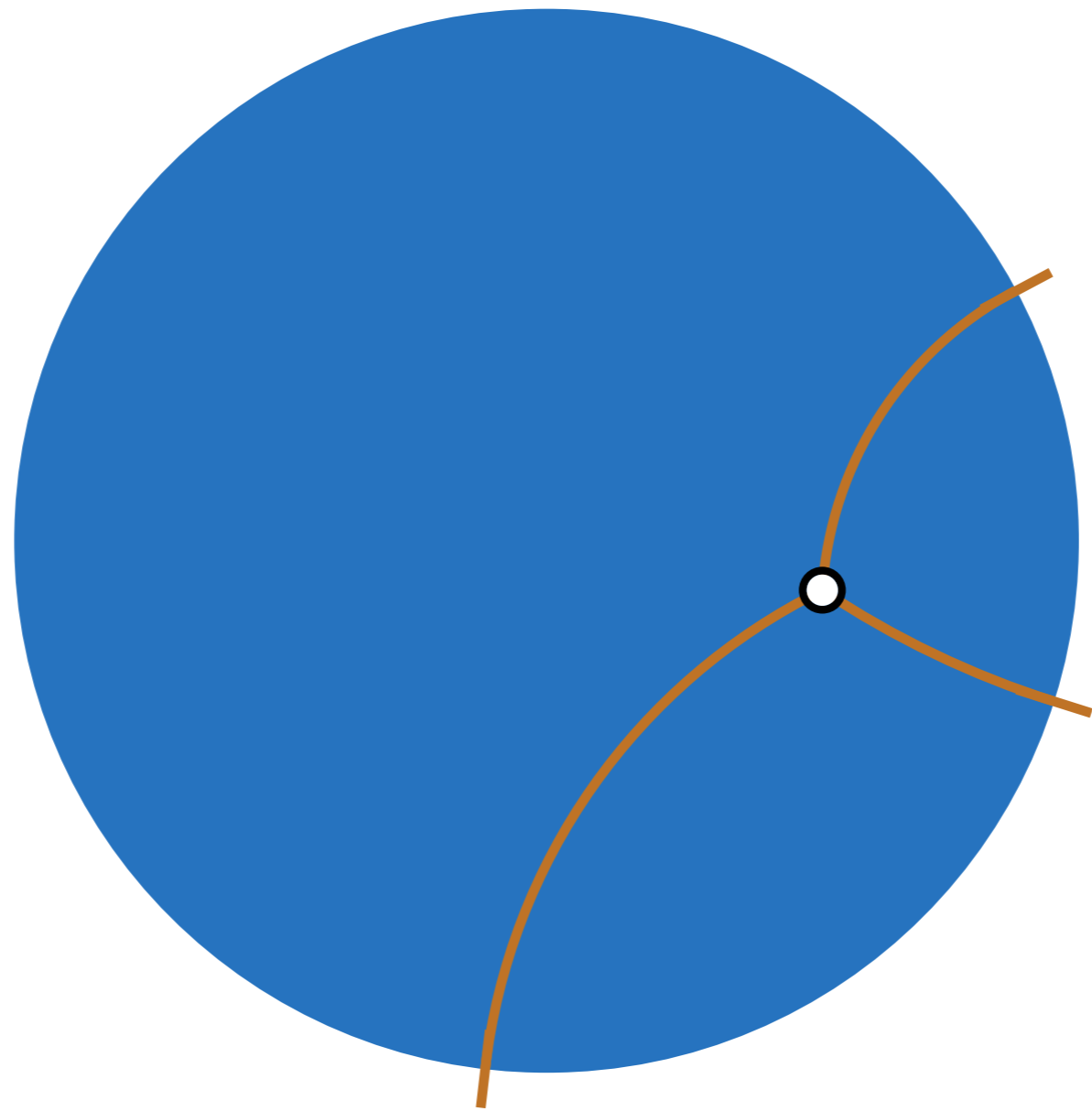
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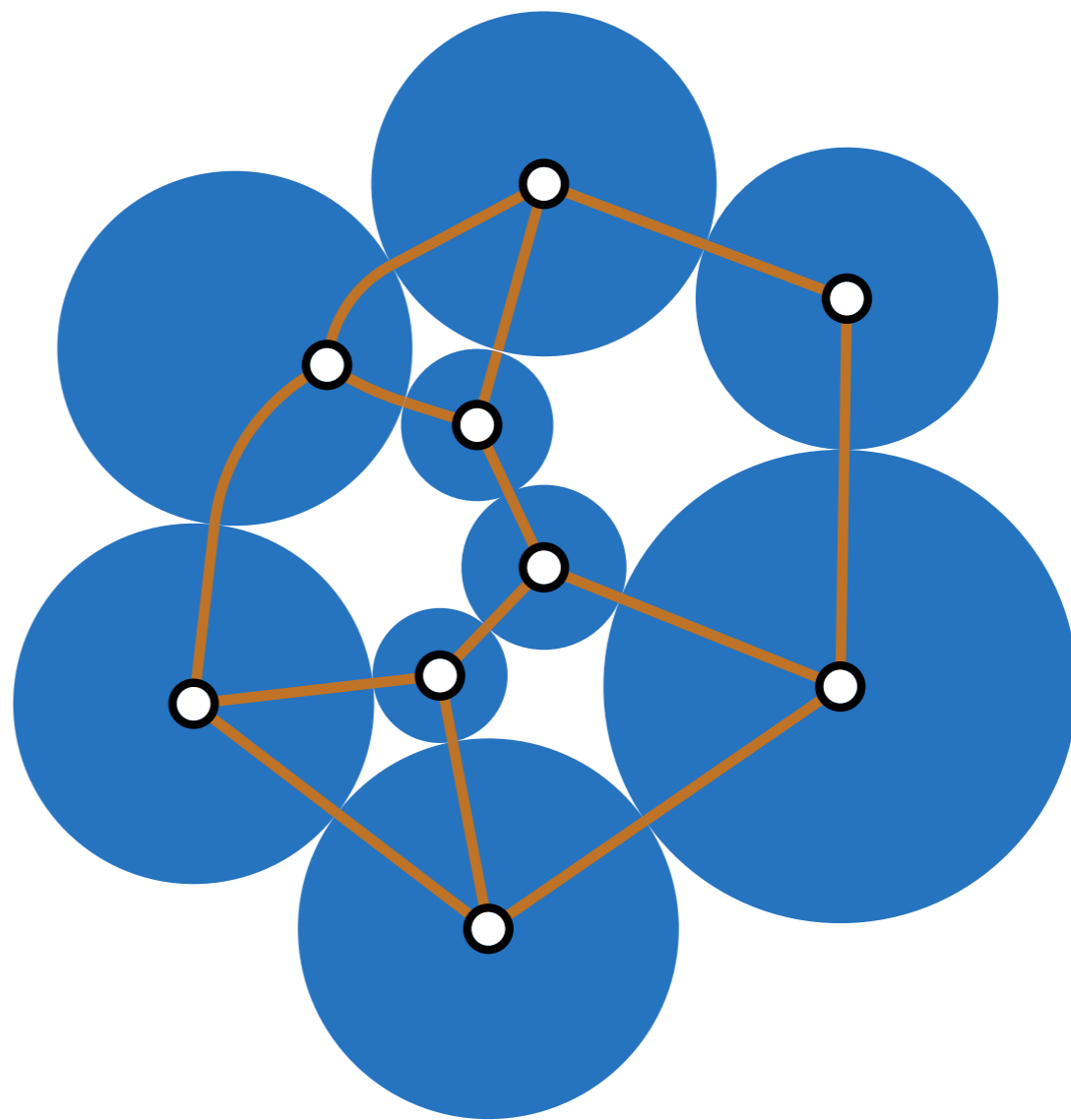
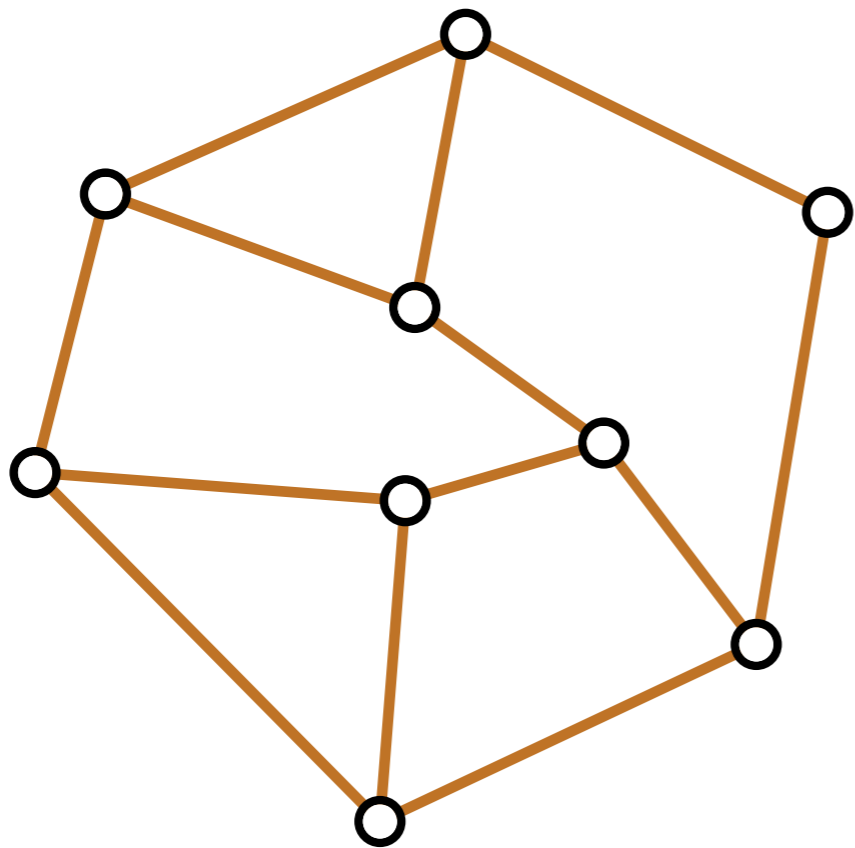
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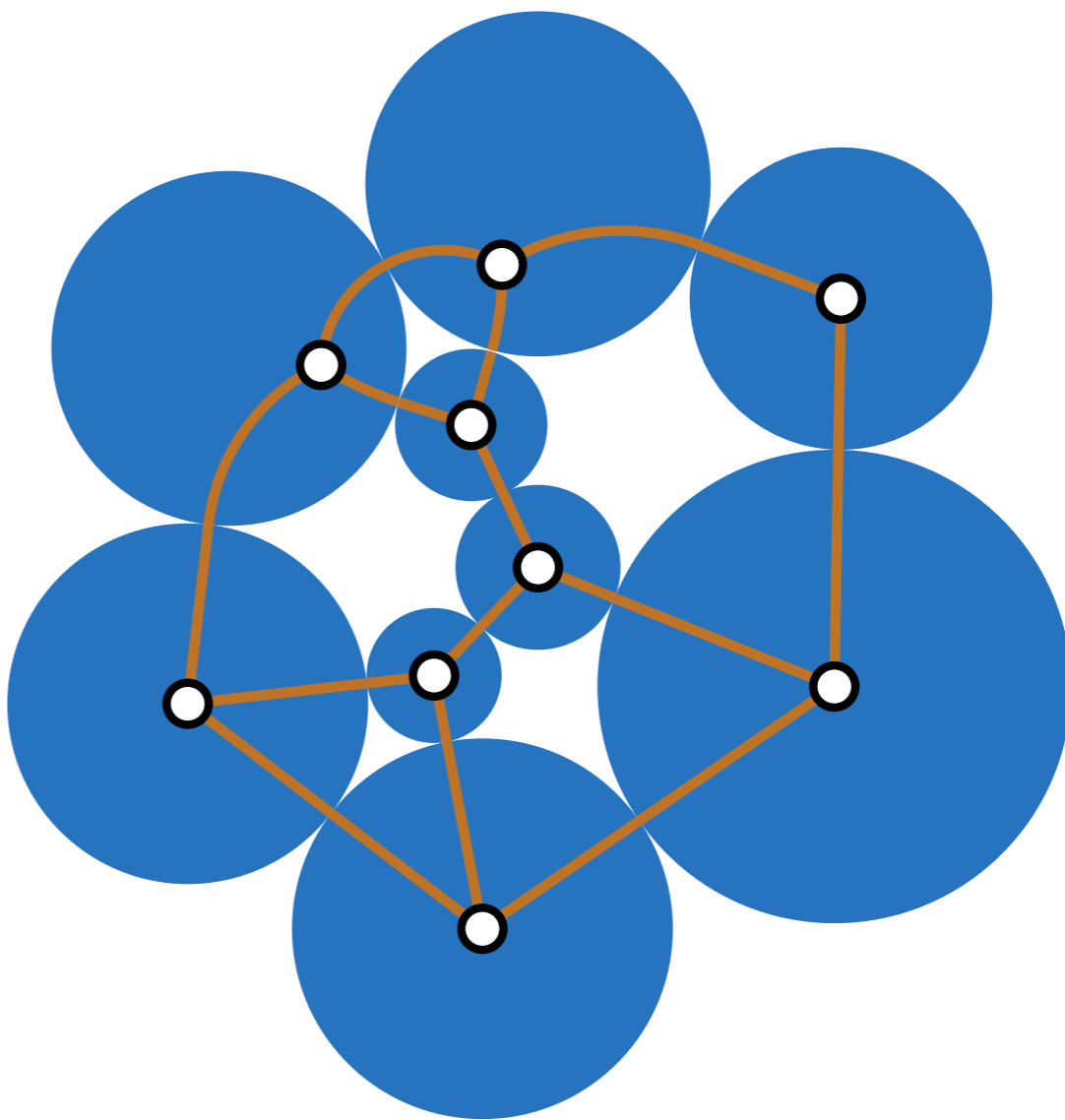
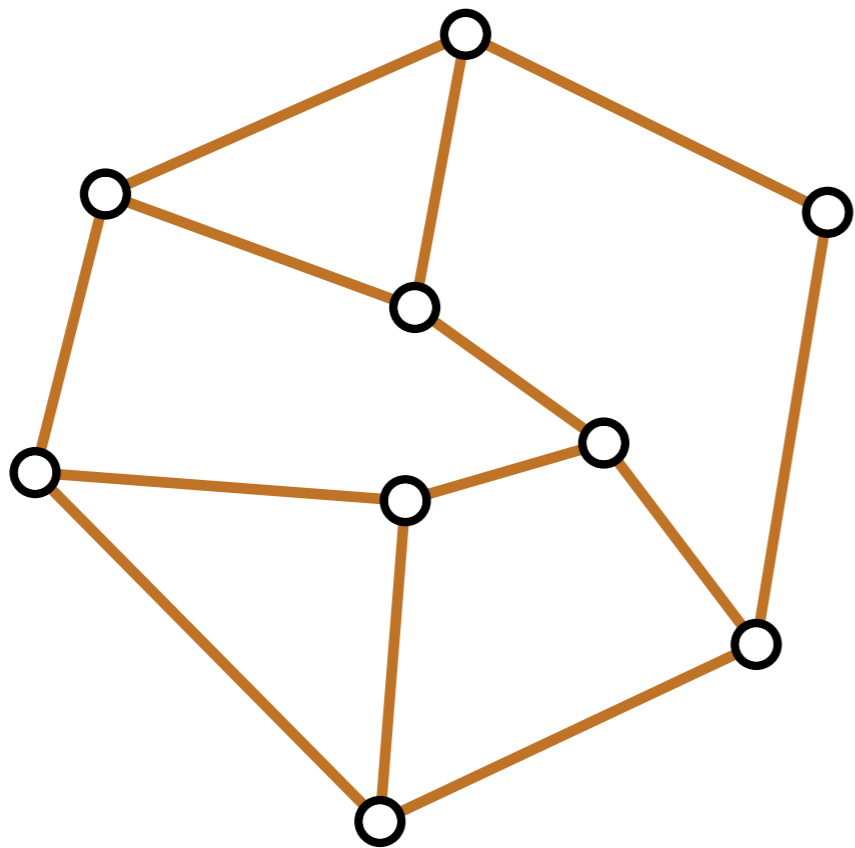
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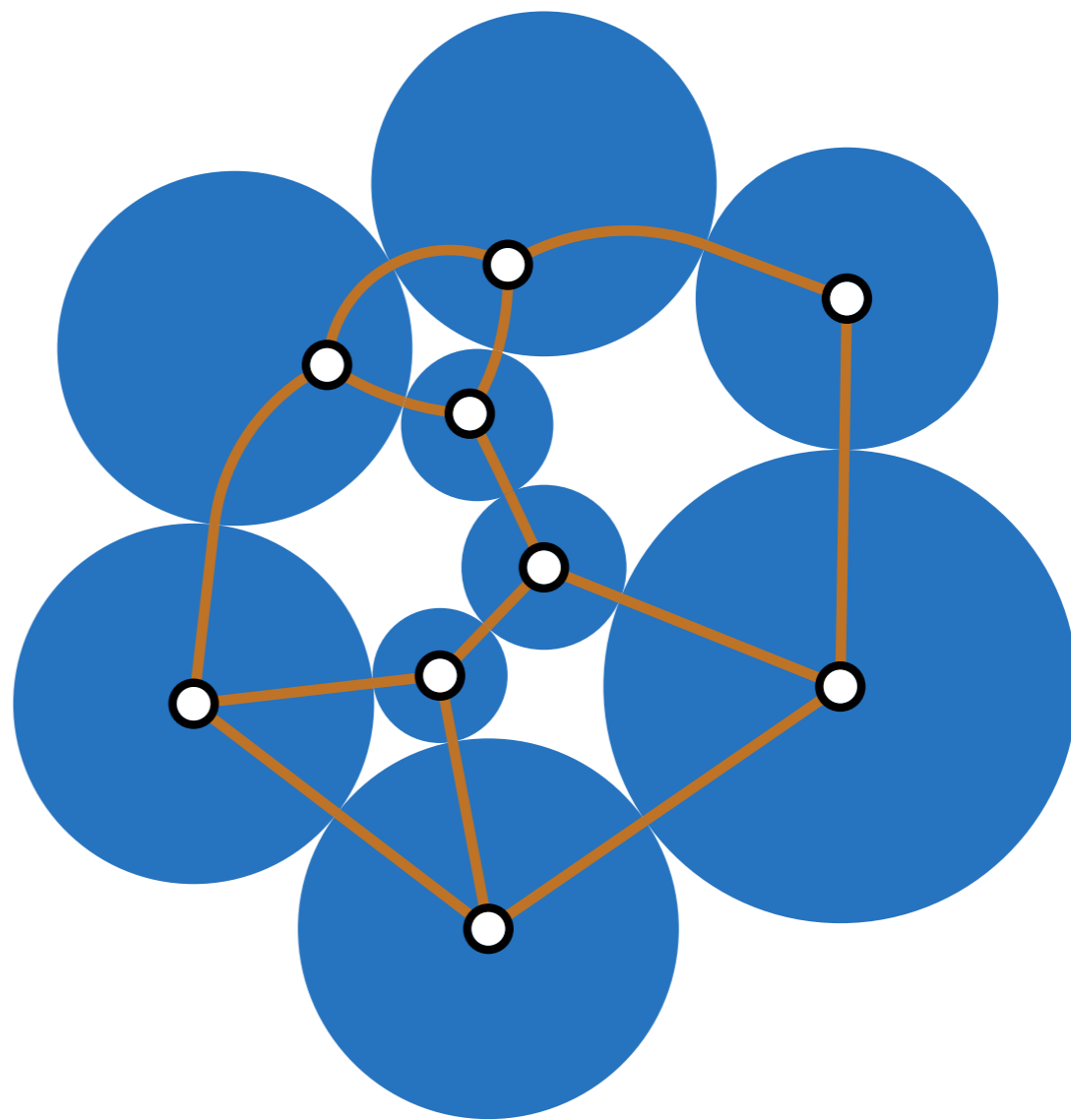
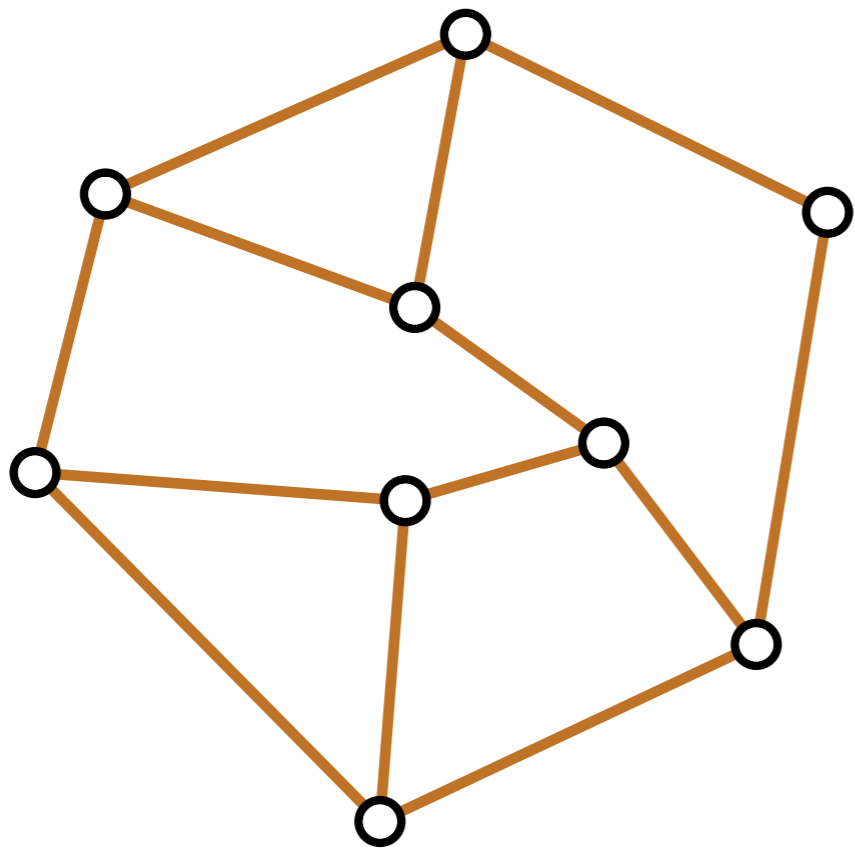
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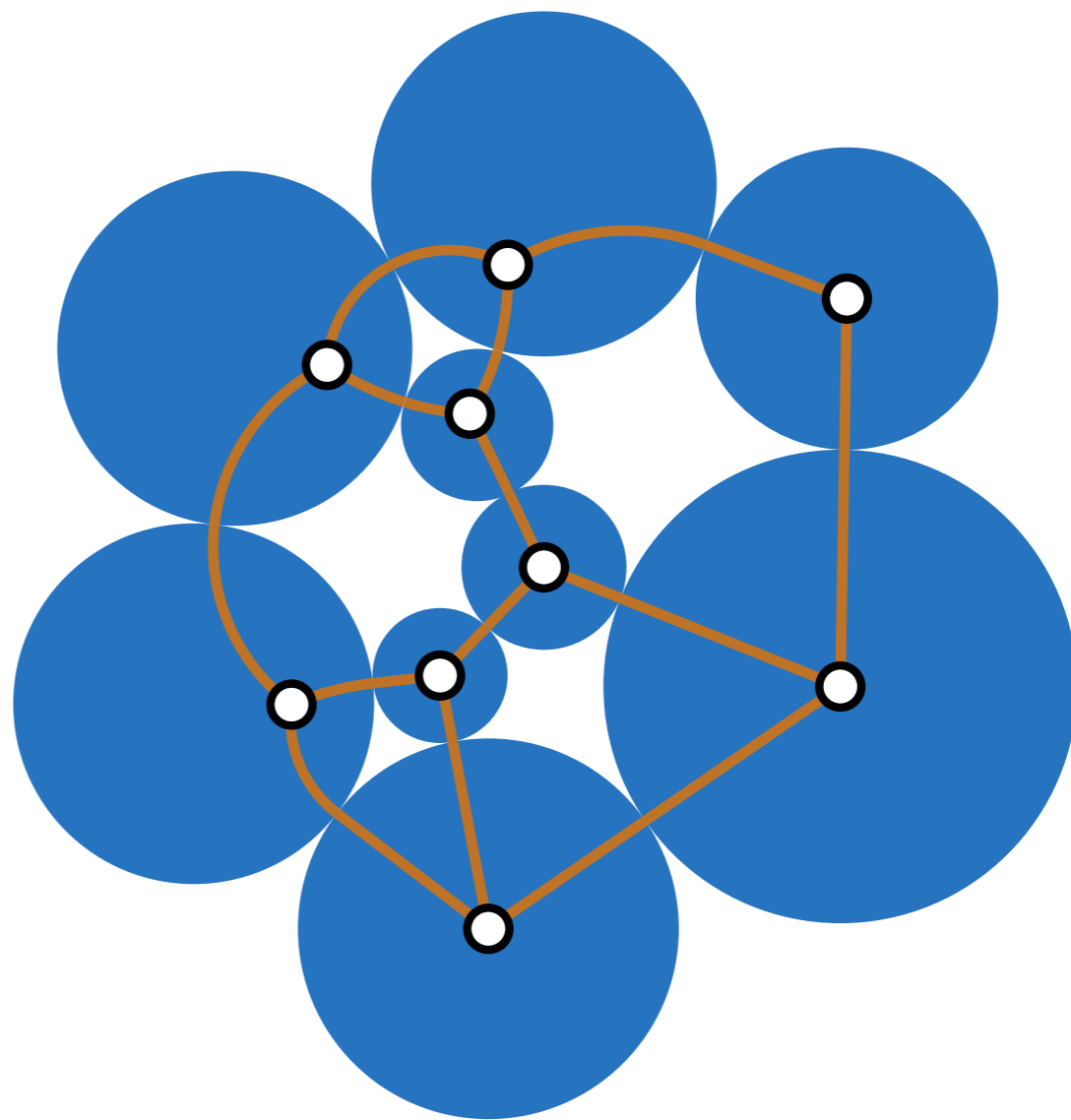
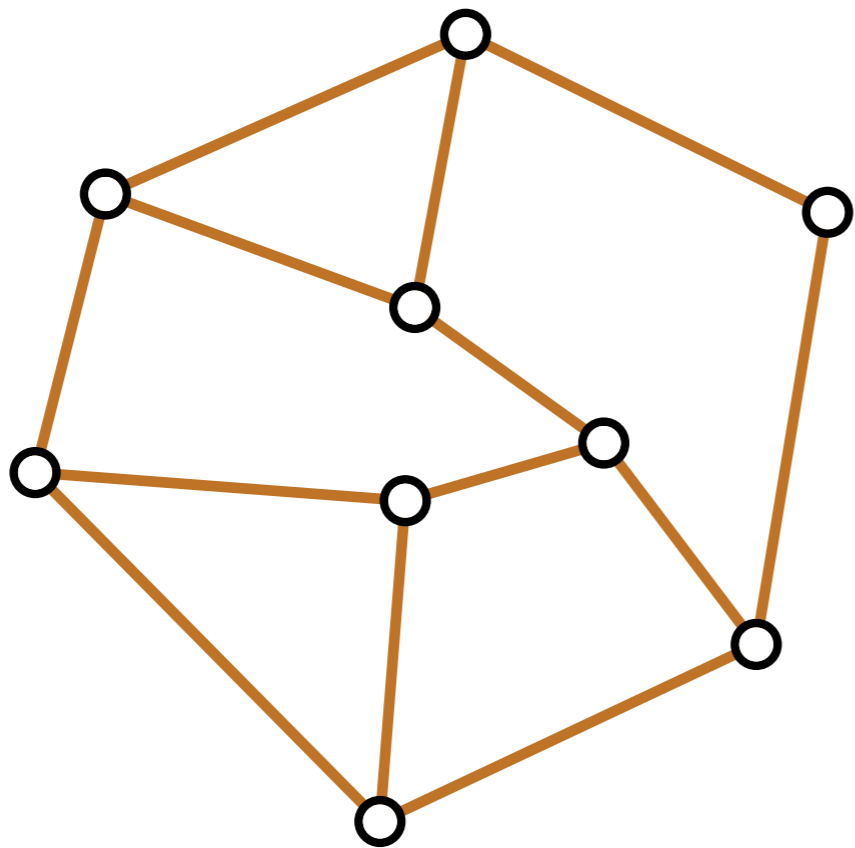
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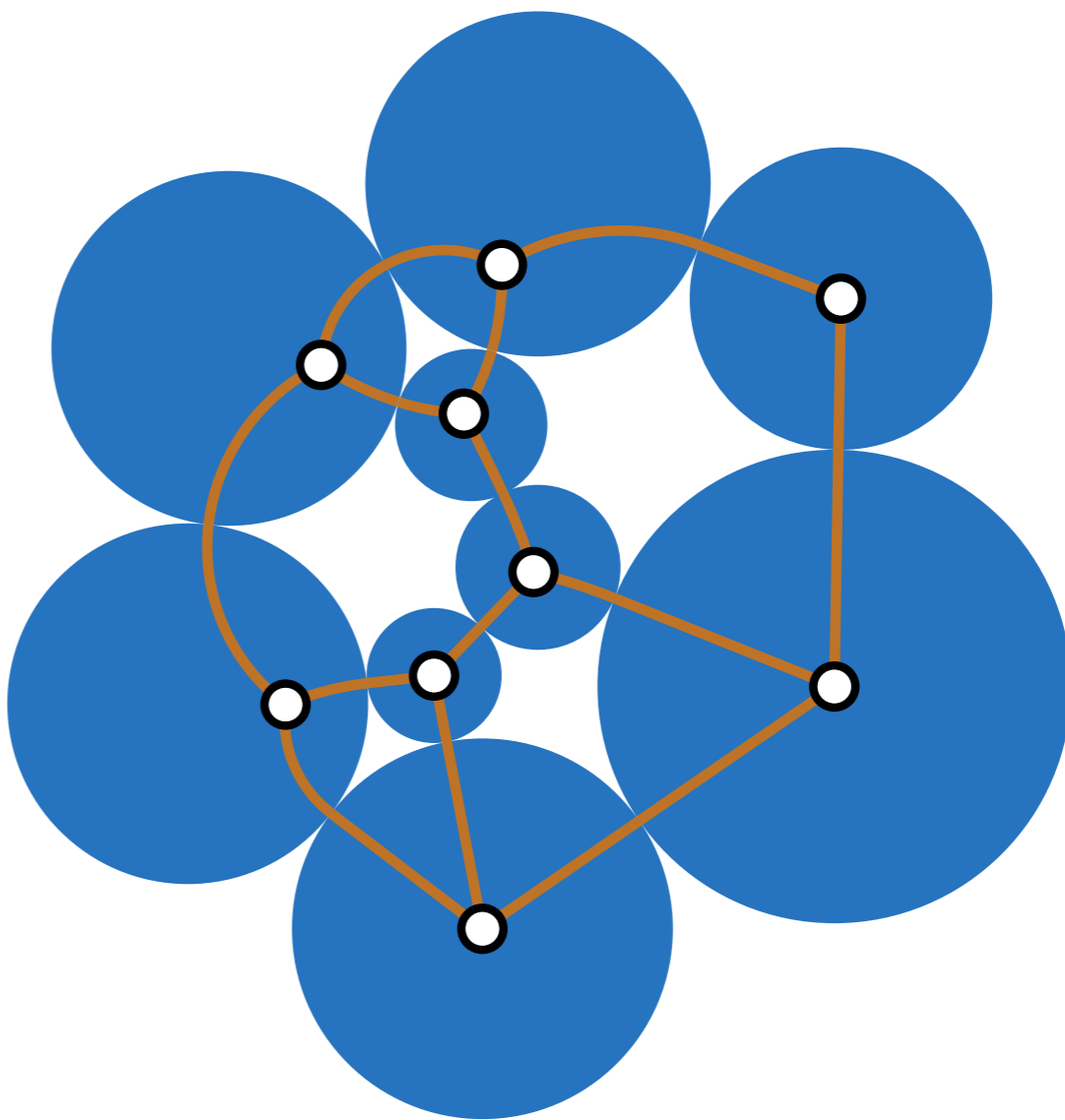
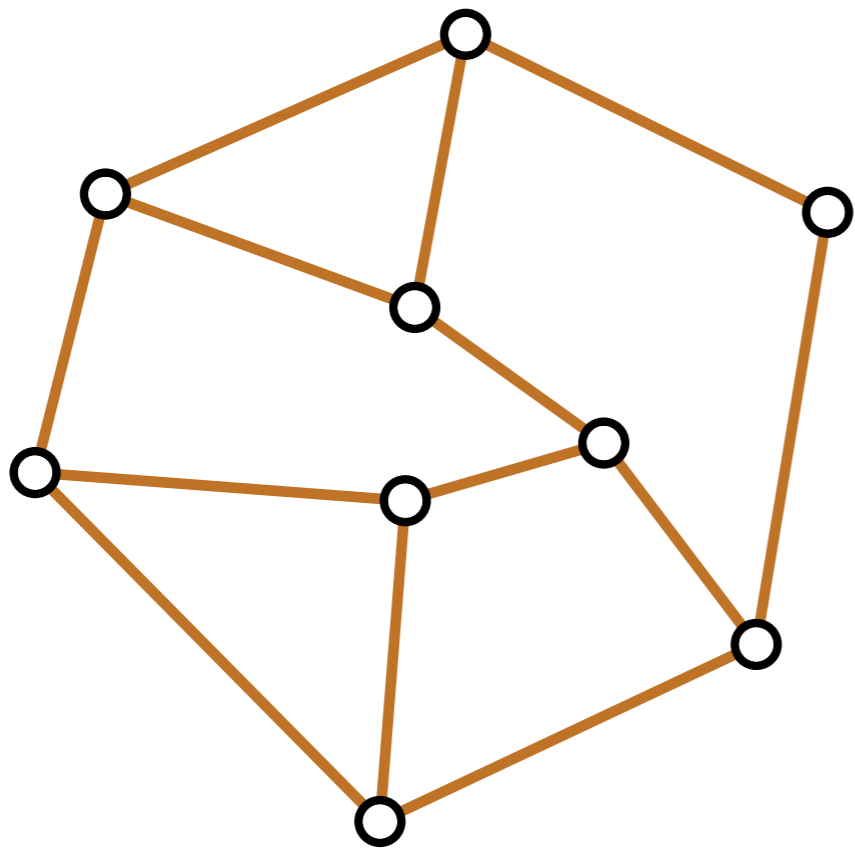
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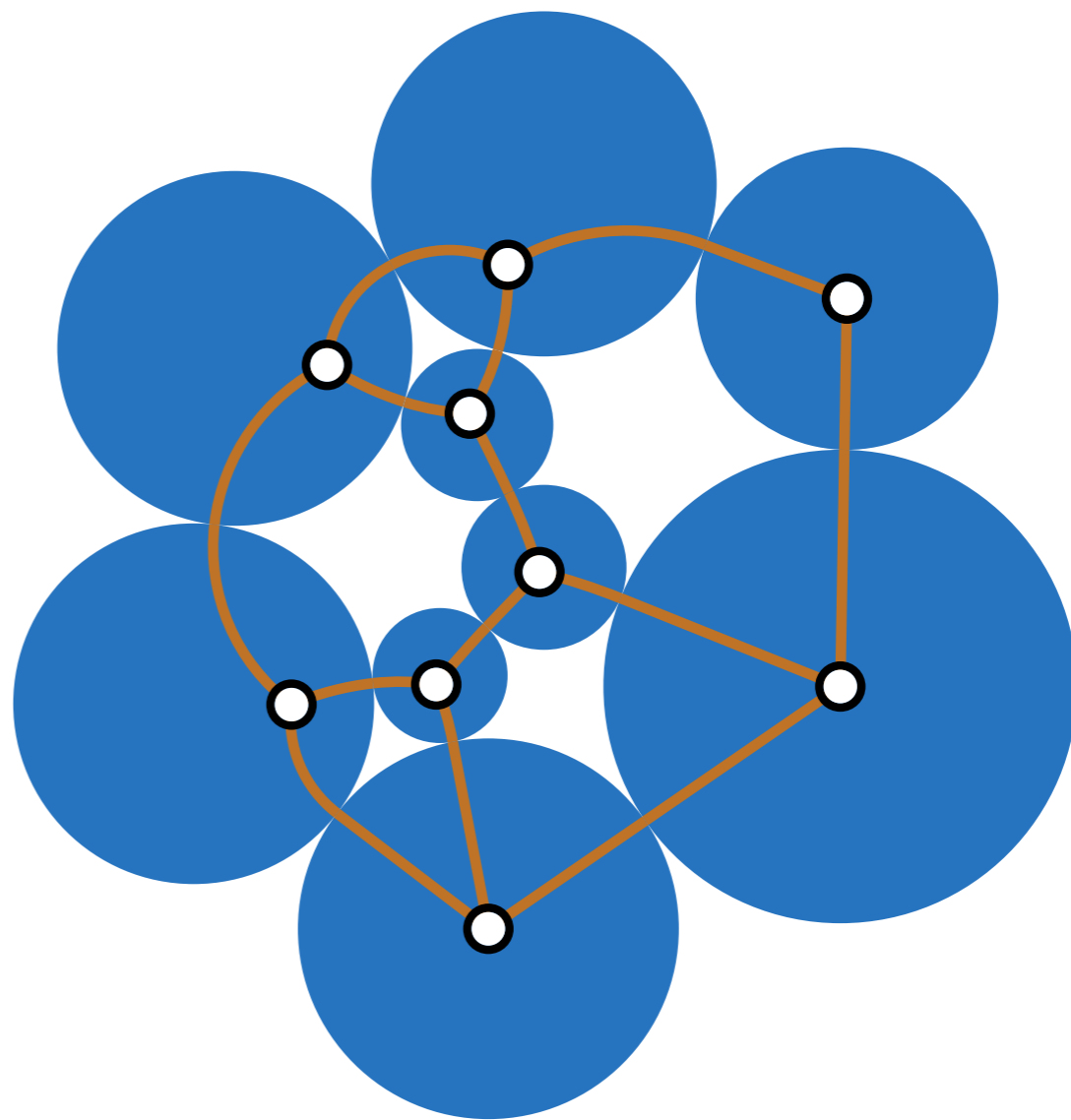
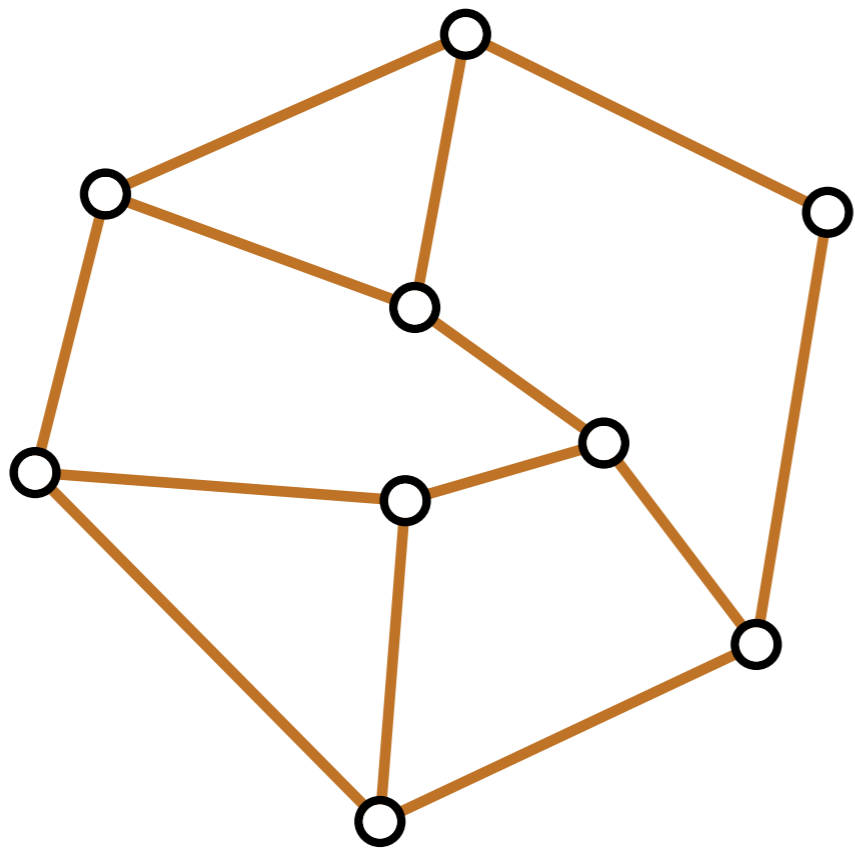
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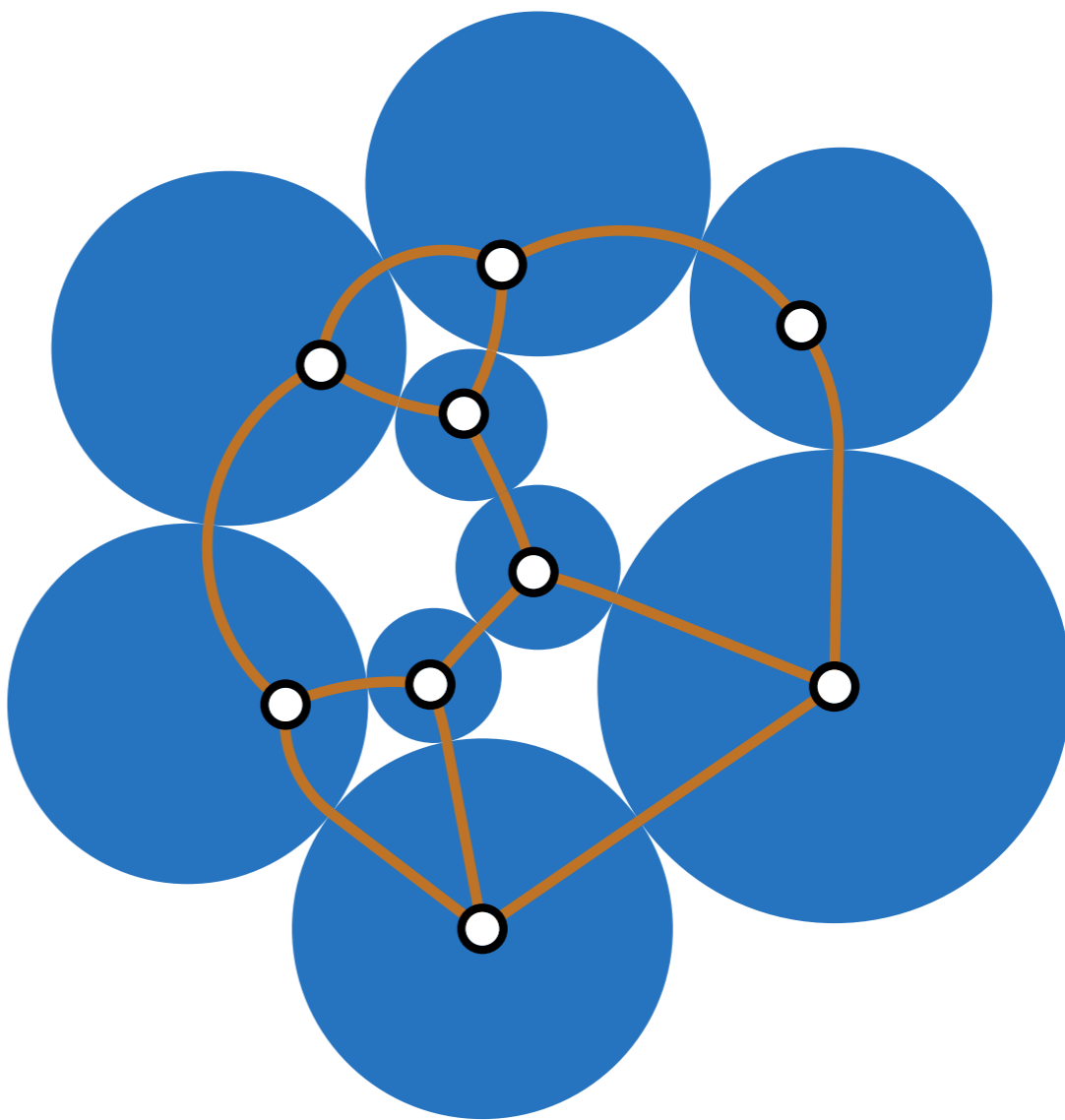
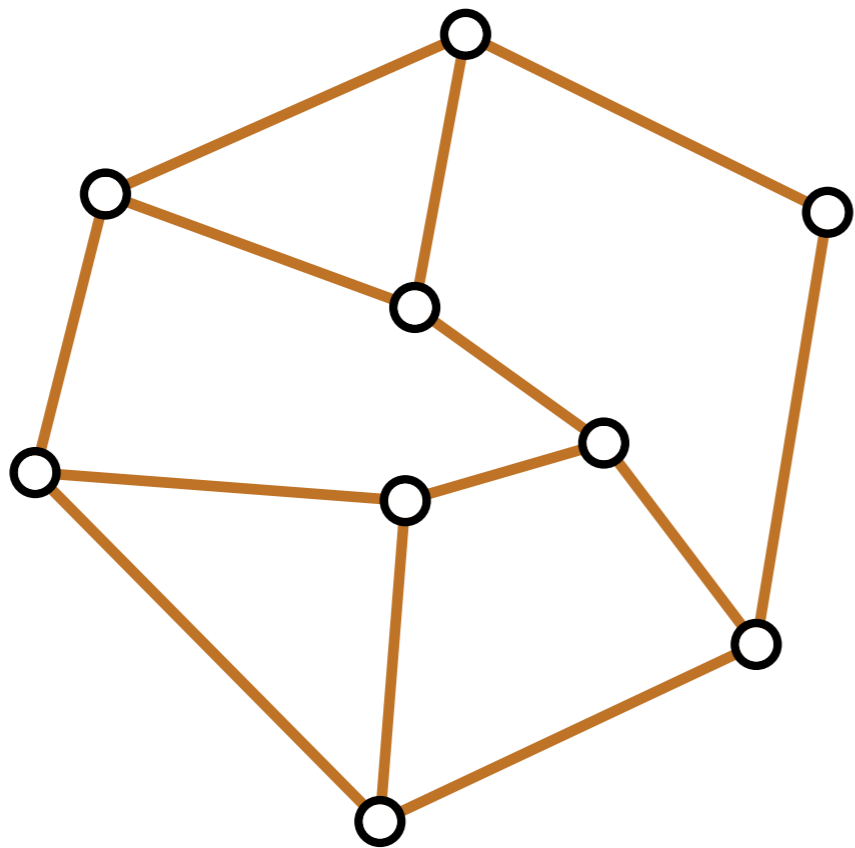
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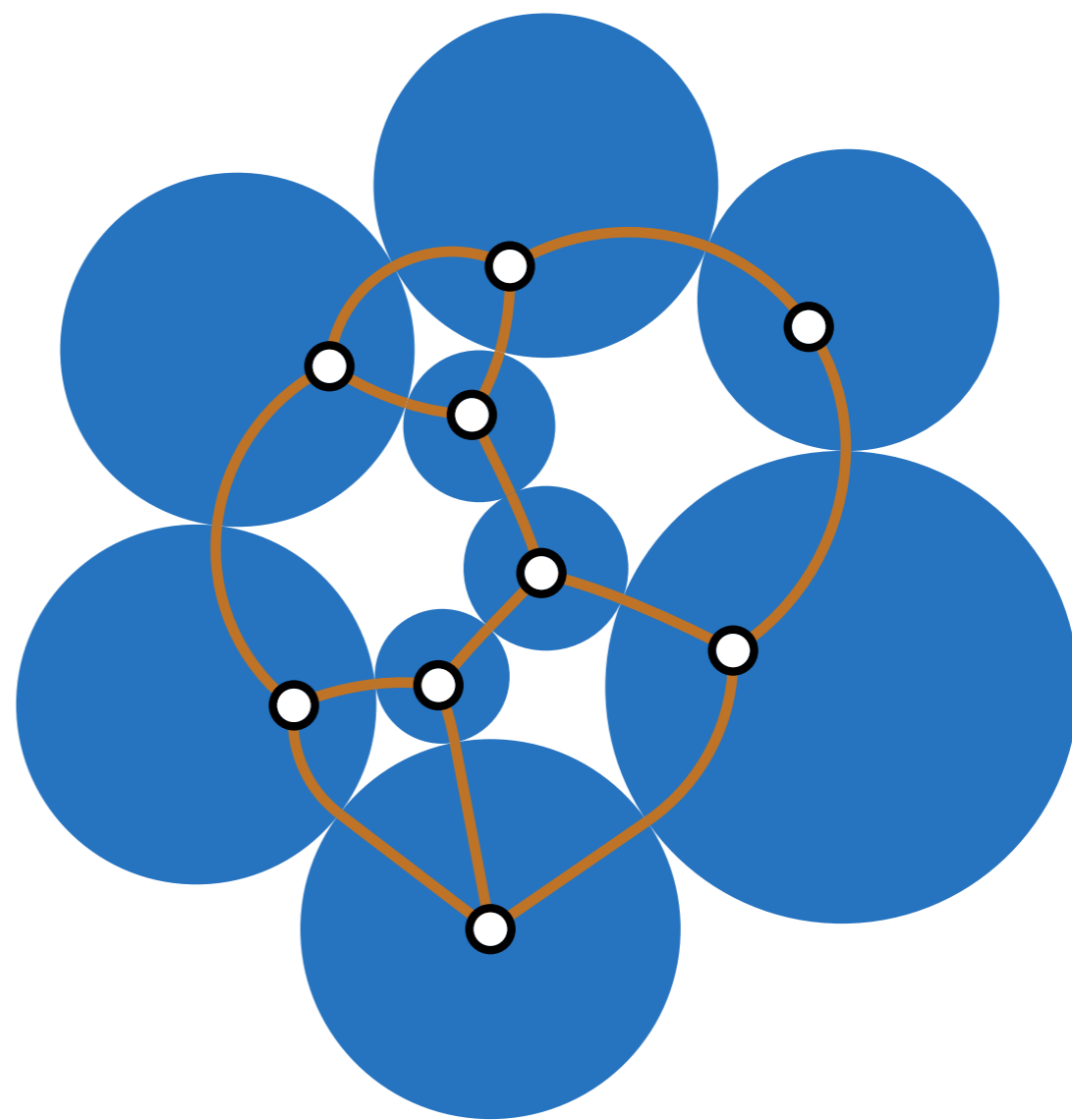
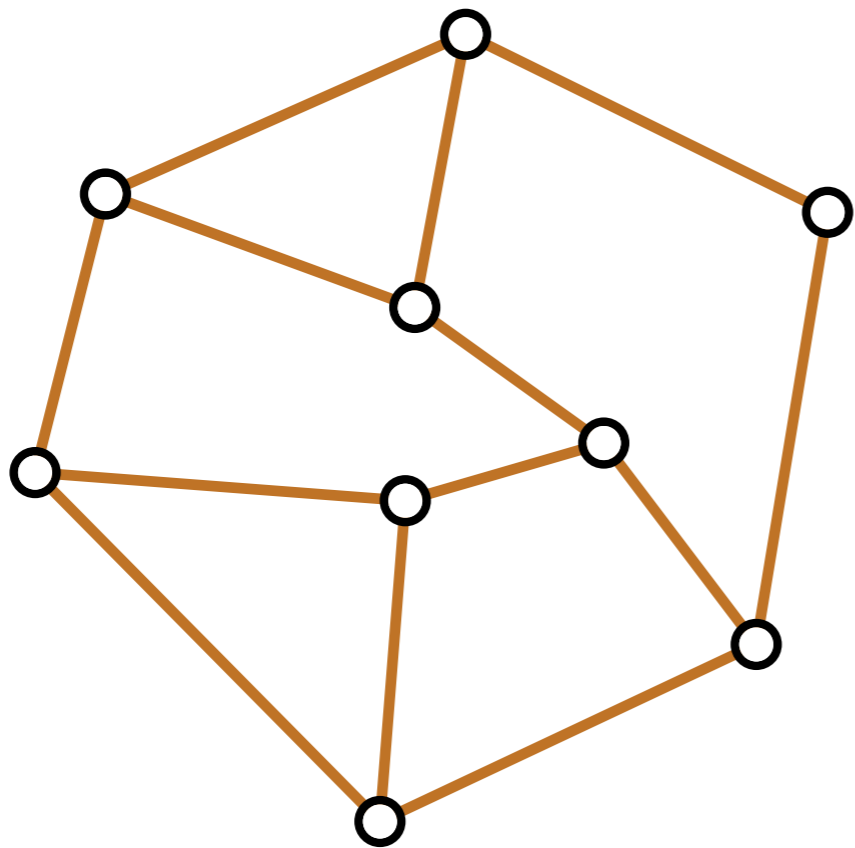
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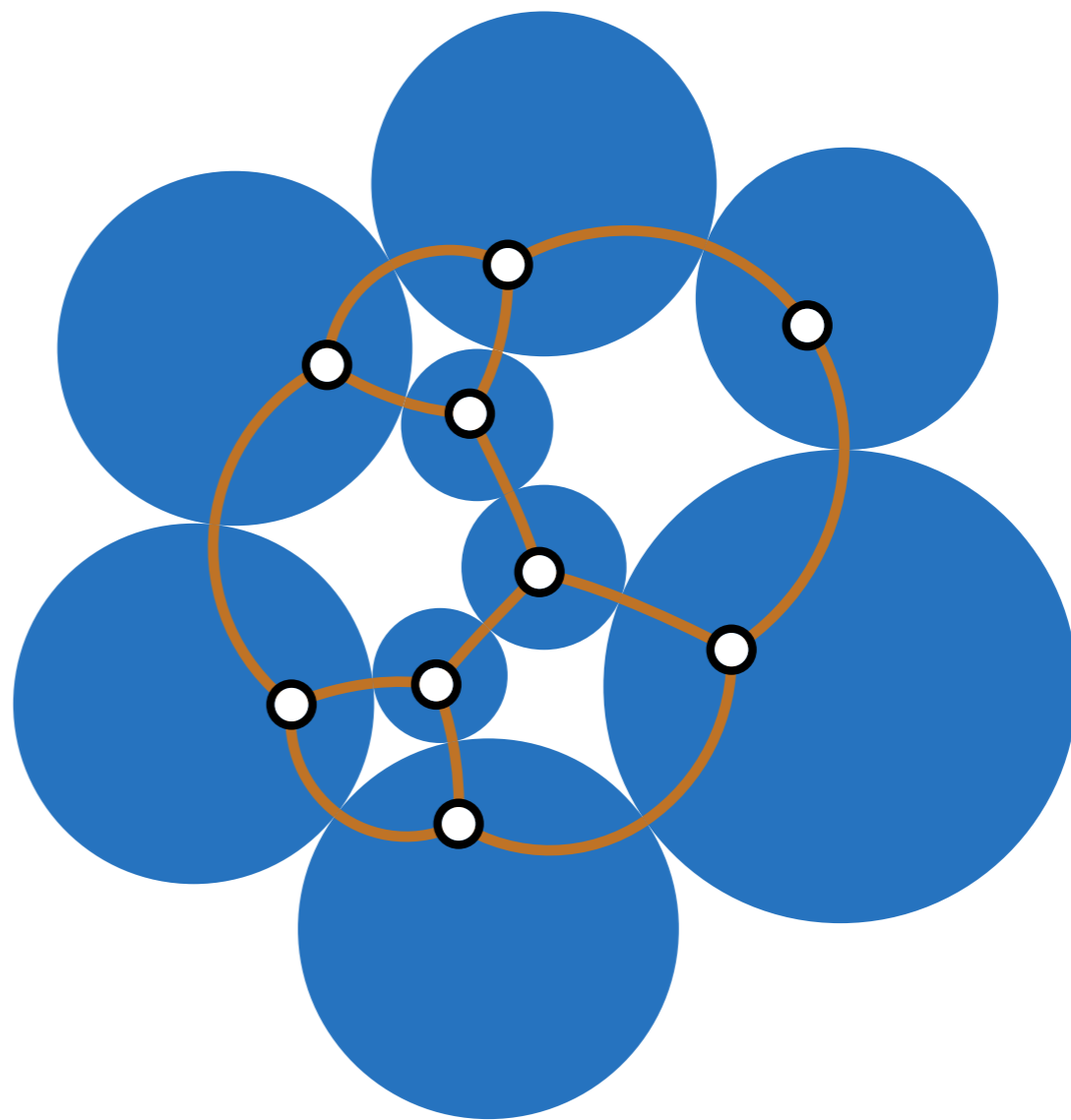
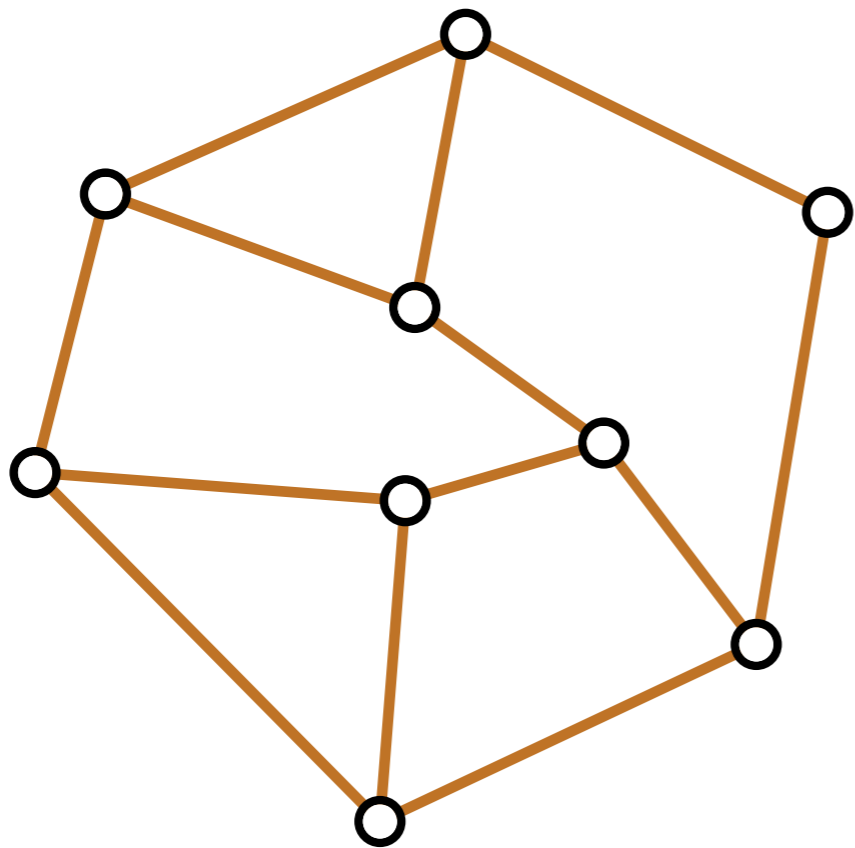
PRESENT A POSITIVE RESULT



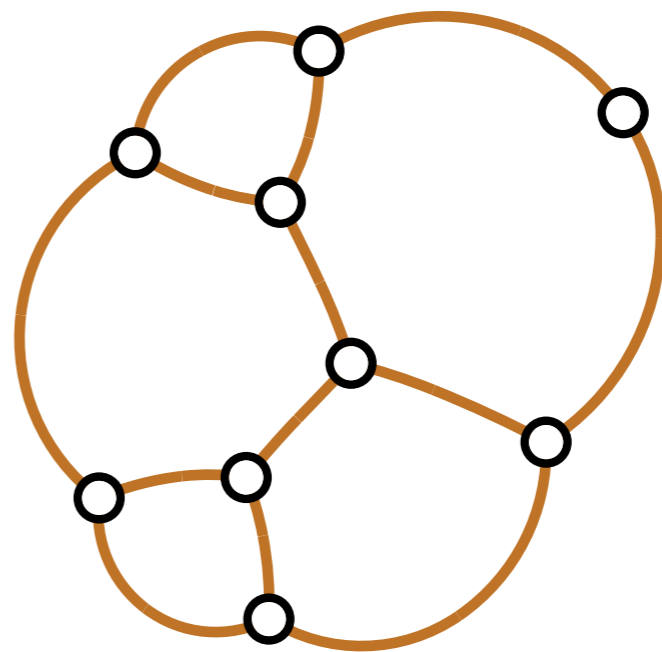
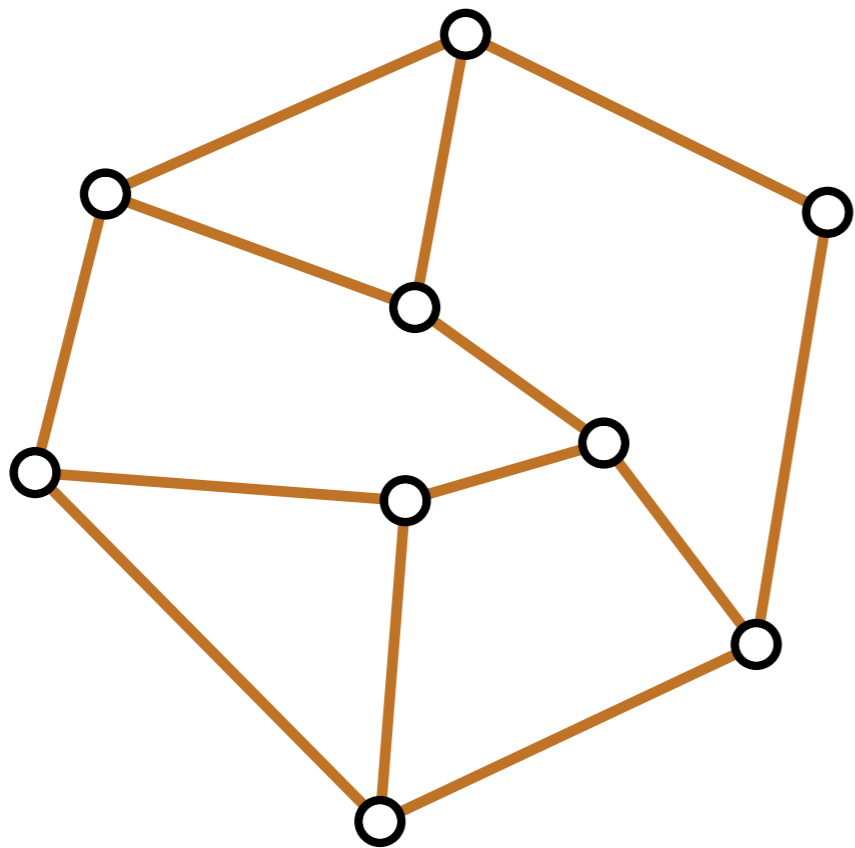
PRESENT A POSITIVE RESULT



PRESENT A POSITIVE RESULT



PRESENT A POSITIVE RESULT



FUTURE OPEN PROBLEMS

FUTURE OPEN PROBLEMS

Do all planar graphs have planar 2-Lombardi drawings?

FUTURE OPEN PROBLEMS

Do all planar graphs have planar 2-Lombardi drawings?

How much area do Lombardi drawings need?

FUTURE OPEN PROBLEMS

Do all planar graphs have planar 2-Lombardi drawings?

How much area do Lombardi drawings need?

What can be done by relaxing the angular resolution requirement?

FUTURE OPEN PROBLEMS

Do all planar graphs have planar 2-Lombardi drawings?

How much area do Lombardi drawings need?

What can be done by relaxing the angular resolution requirement?

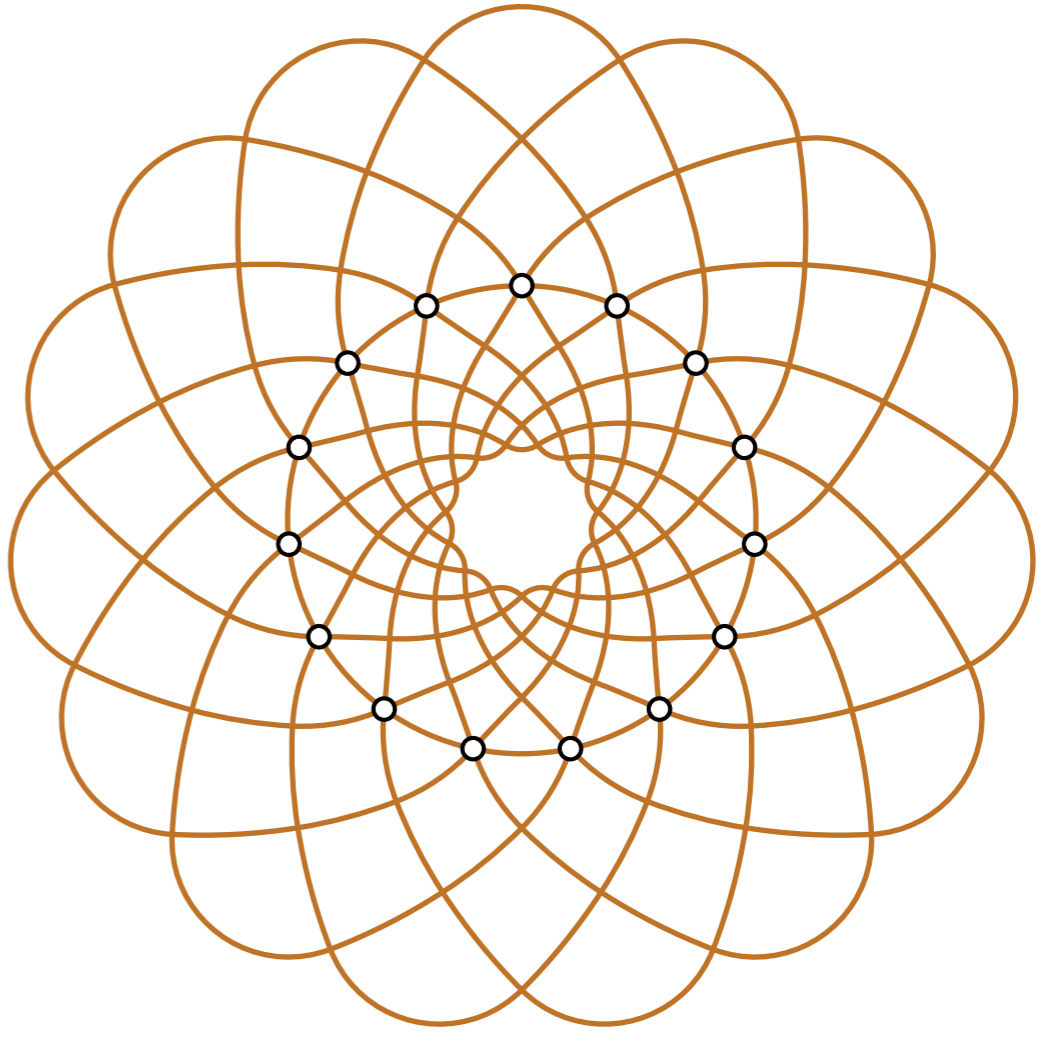
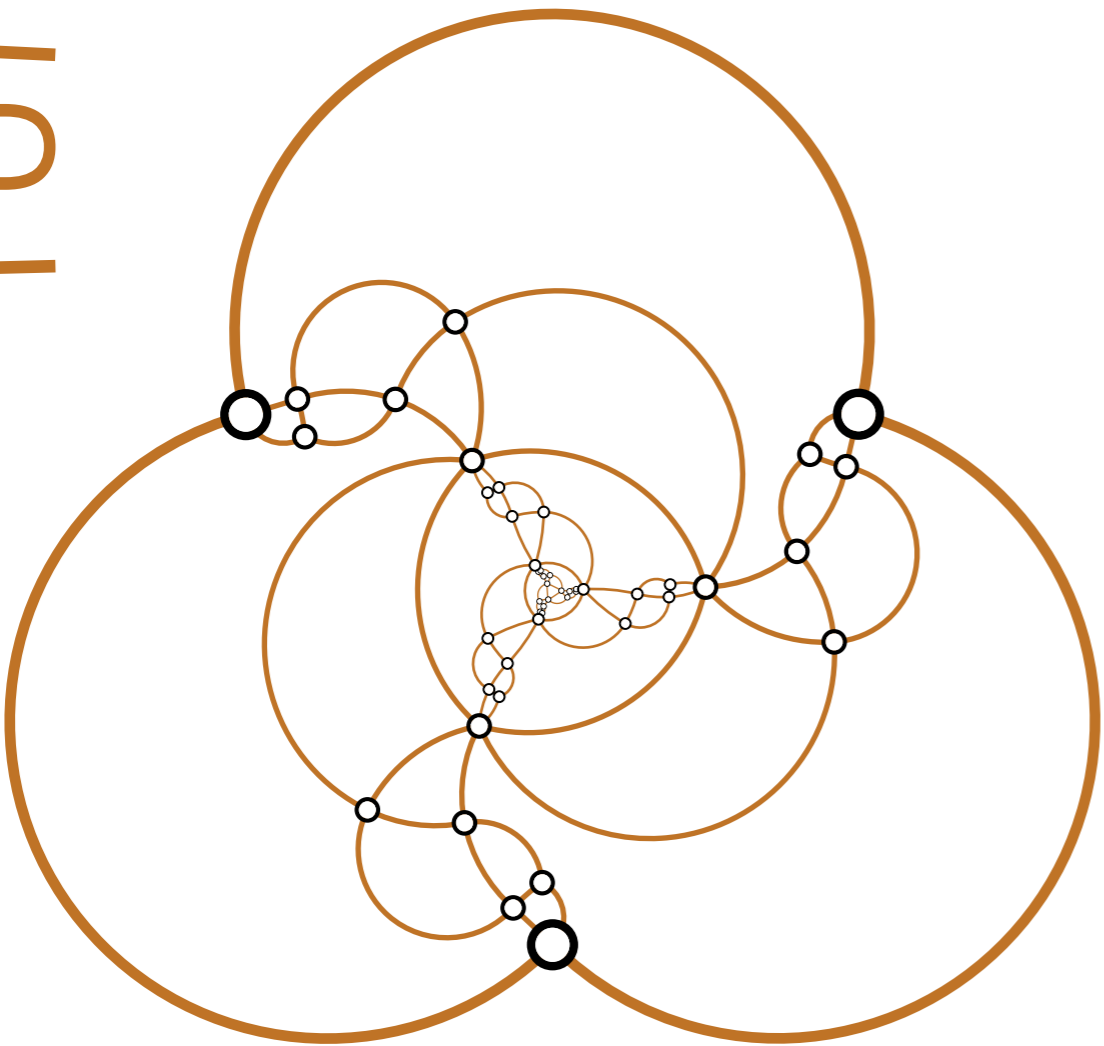
Do outerplanar graphs have planar Lombardi drawings?

FUTURE QUESTIONS?

PLANAR

&

POLY-ARC



LOMBARDI DRAWINGS