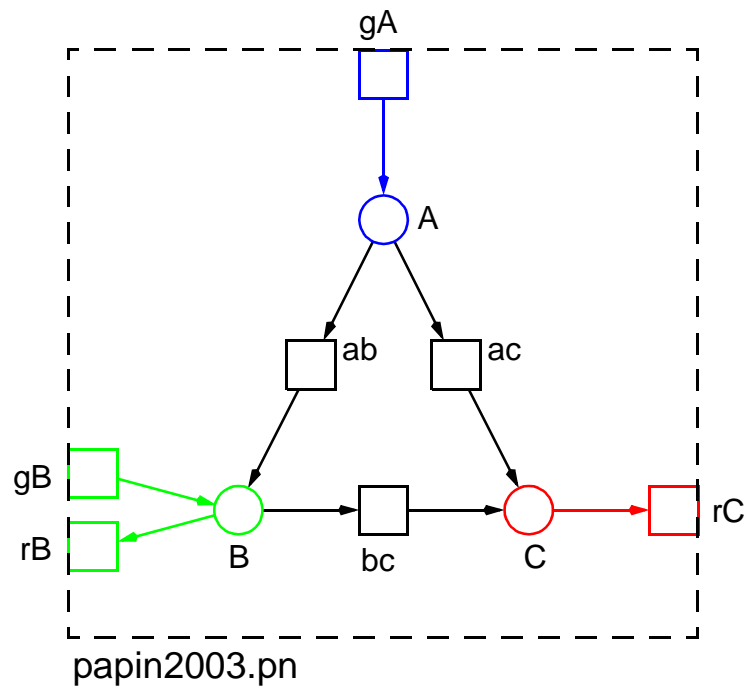


T-INVARIANTS
ELEMENTARY MODES
EXTREME PATHWAYS

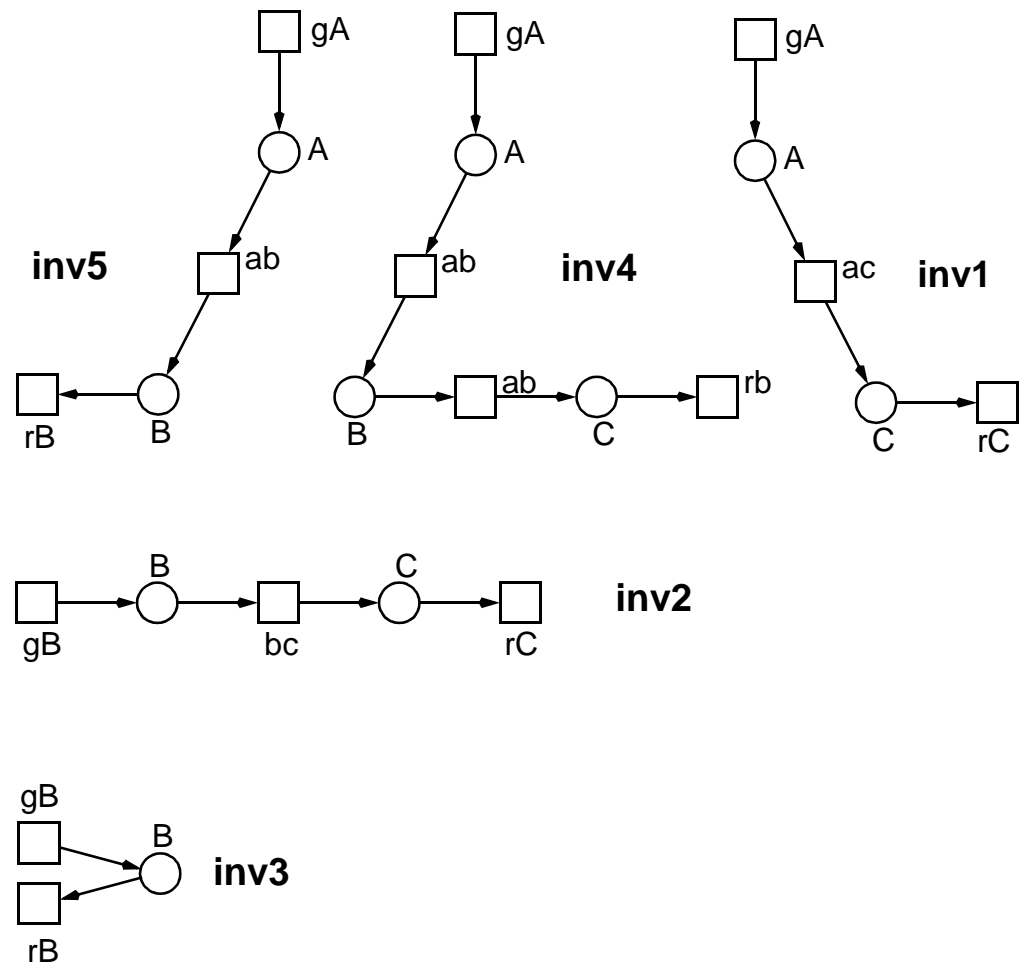
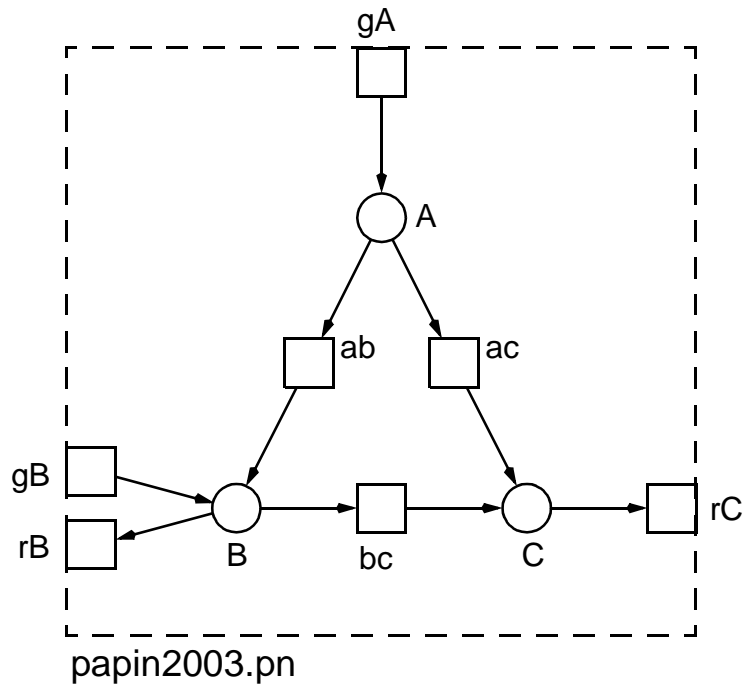
EXAMPLE

- substances involved
 - > *input substance A*
 - > *output substance C*
 - > *auxiliary substance B*



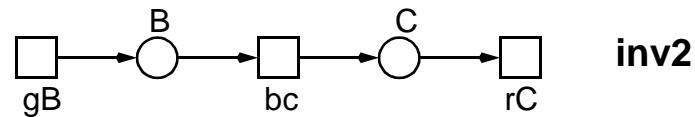
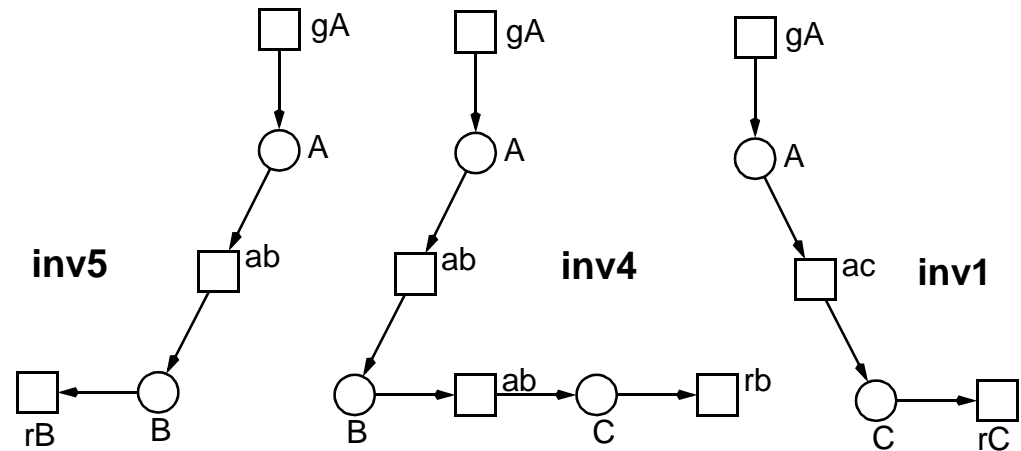
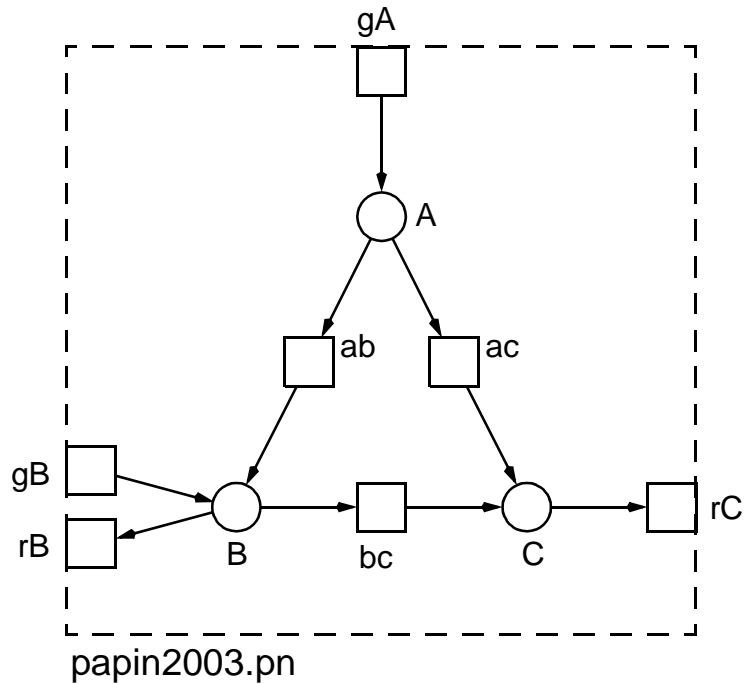
EXAMPLE - T-INVARIANTS

- substances involved
- > *input substance A*
- > *output substance C*
- > *auxiliary substance B*



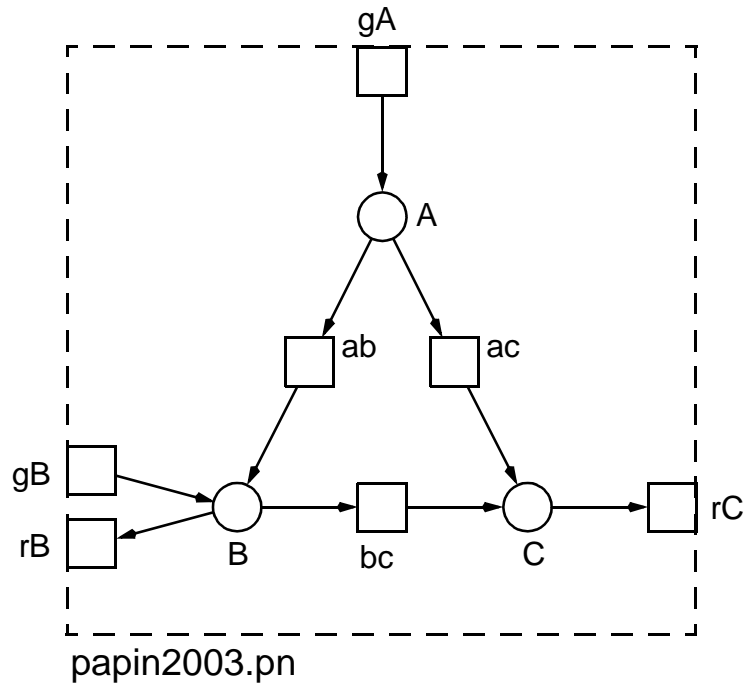
EXAMPLE - ELEMENTARY MODES

- substances involved
- > *input substance A*
- > *output substance C*
- > *auxiliary substance B*

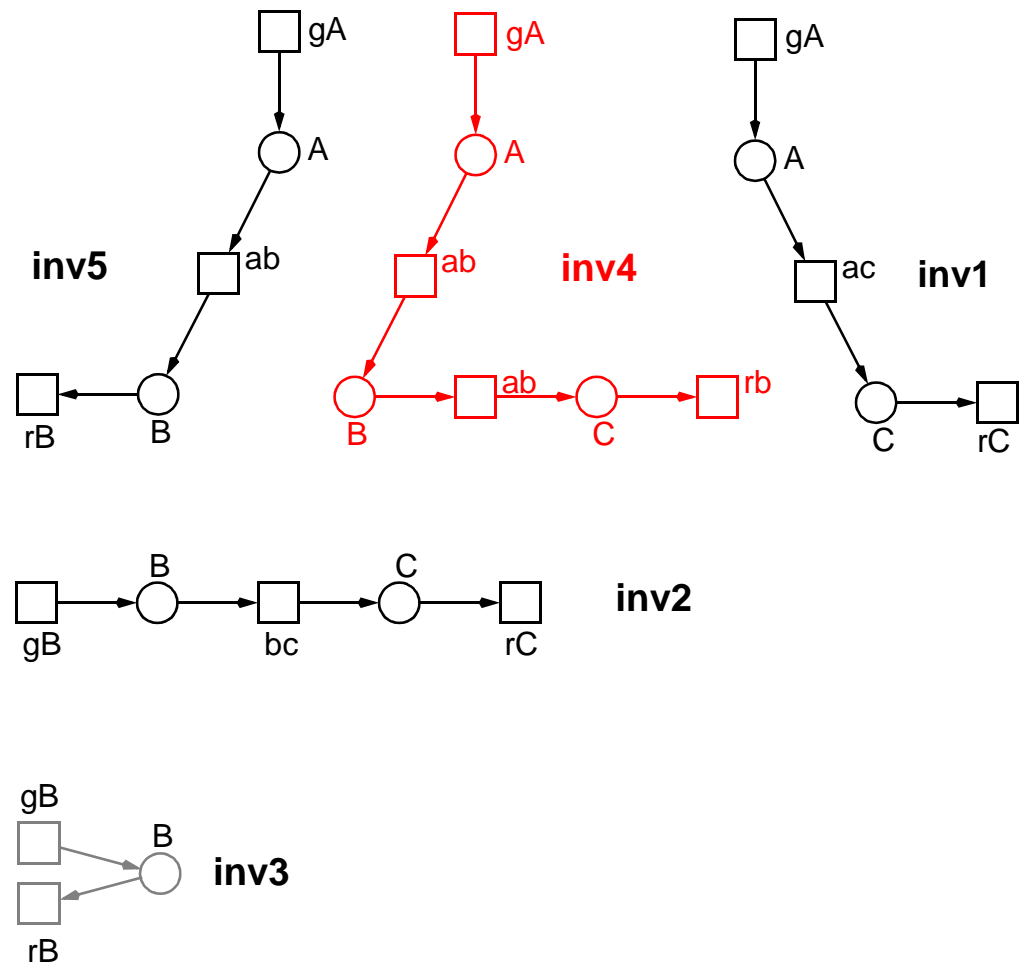


EXAMPLE - EXTREME PATHWAYS

- substances involved
- > *input substance A*
- > *output substance C*
- > *auxiliary substance B*

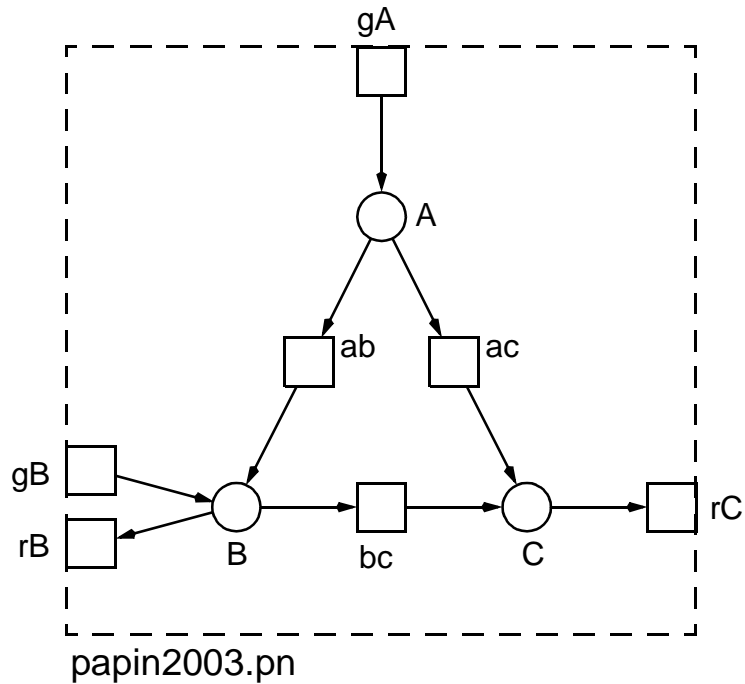


no extreme pathway

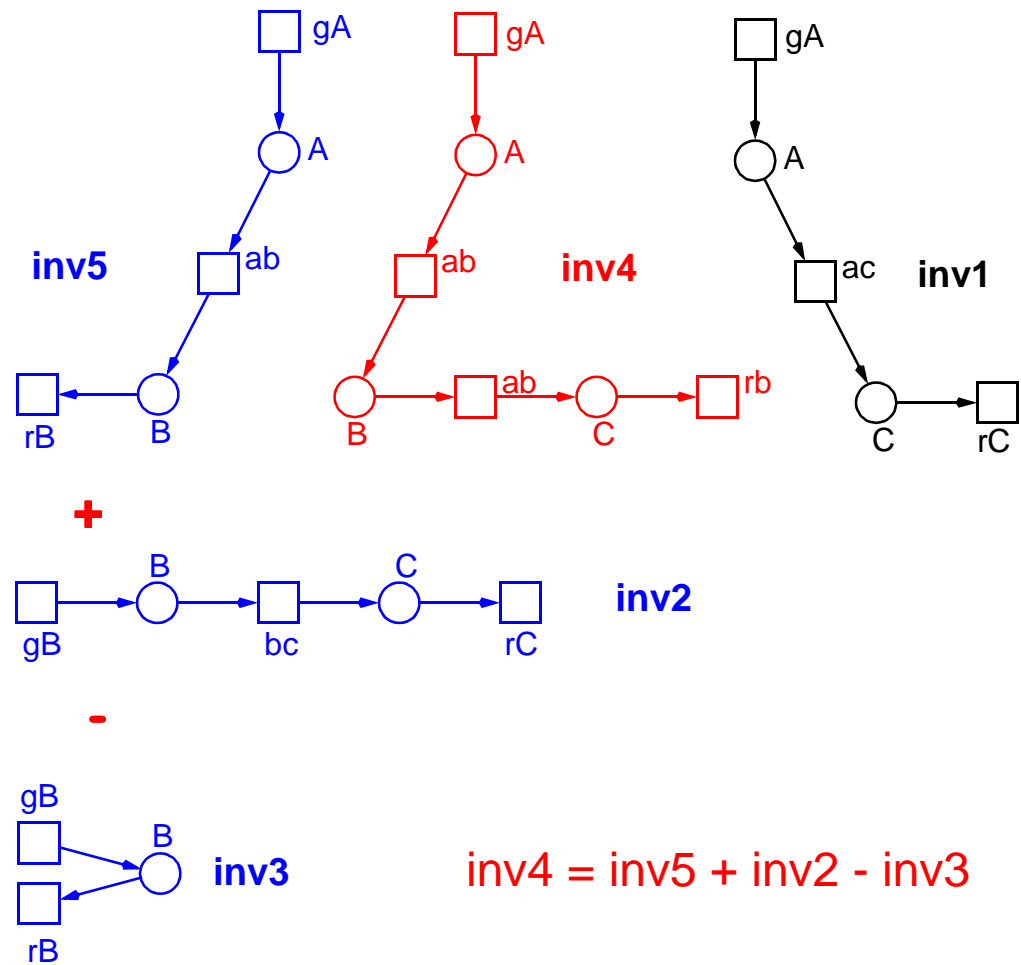


EXAMPLE - EXTREME PATHWAYS

- substances involved
- > *input substance A*
- > *output substance C*
- > *auxiliary substance B*

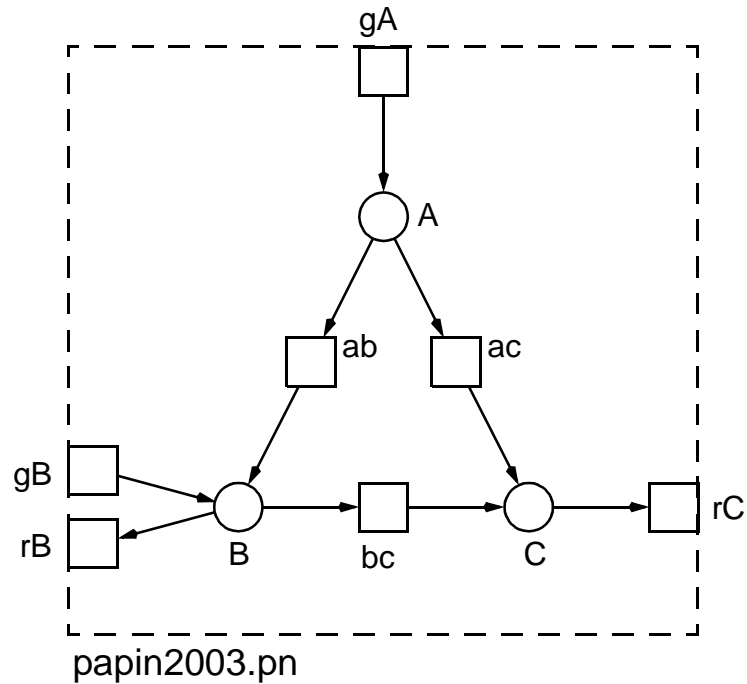


no extreme pathway

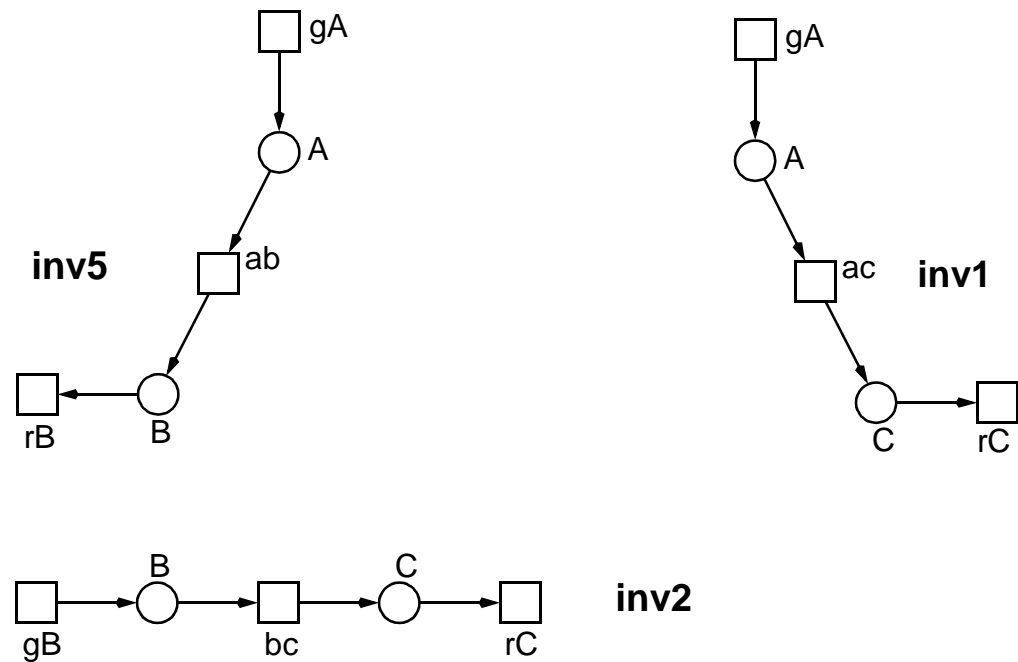


EXAMPLE - SUMMARY

- substances involved
 - > *input substance A*
 - > *output substance C*
 - > *auxiliary substance B*



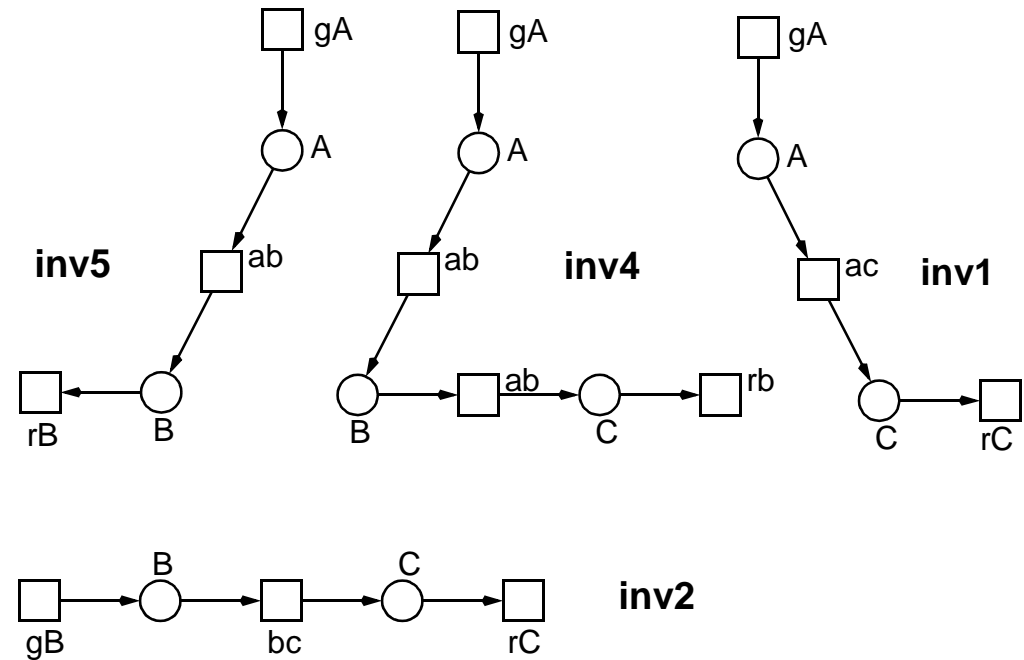
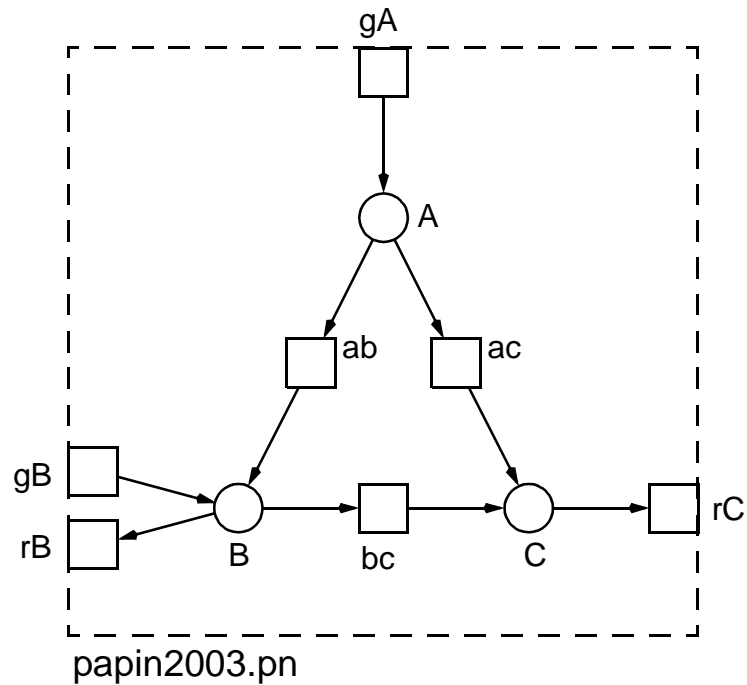
EXTREME PATHWAYS



EXAMPLE - SUMMARY

- substances involved
- > *input substance A*
- > *output substance C*
- > *auxiliary substance B*

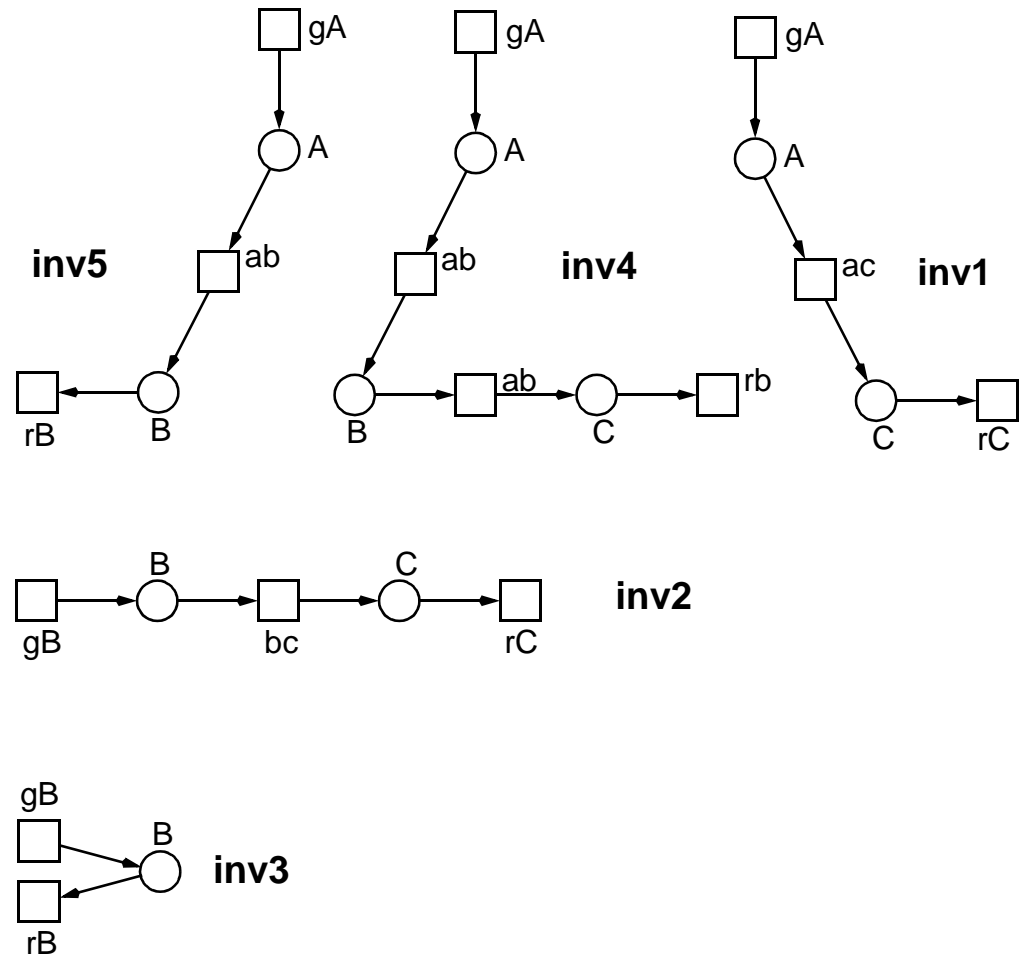
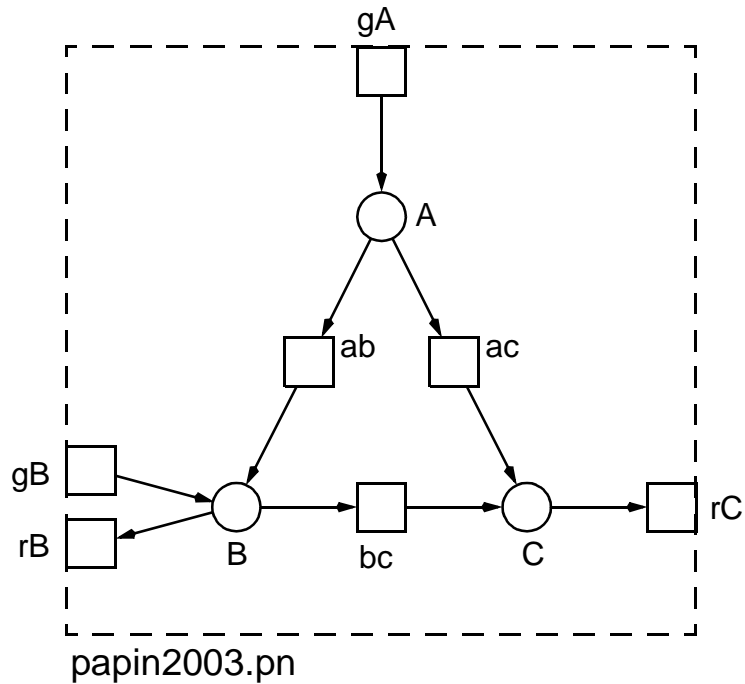
ELEMENTARY MODES



EXAMPLE - SUMMARY

- substances involved
- > *input substance A*
- > *output substance C*
- > *auxiliary substance B*

MINIMAL T-INVARIANTS



THE NOTIONS

**T-INVARIANTS,
ELEMENTARY MODES, AND
EXTREME PATHWAYS**

COINCIDE

**FOR BIOCHEMICAL SYSTEMS
WITHOUT REVERSIBLE REACTIONS.**

- ❑ JA Pain et al.:
Metabolic pathways in the post-genome era (Review);
Trends in Biochemical Sciences 28(2003)5, pp. 250-258.

- ❑ M Heiner:
Understanding Network Behaviour by Structured Representations of Transition
Invariants – A Petri Net Perspective on Systems and Synthetic Biology;
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