Binary Decision Diagrams (BDD)

BDD History

Original idea for Binary decision Diagram due to Lee (1959) and Akers (1978)
Critical Refinement-Ordered BDDs -due to Bryant (1986)

- Refinement impose some restrictions on structure
- Restrictions needed to make result canonical representation

Terminology;

A BDD is a directed Acyclic graph

- **Graph**: Vertices connected by edges
- **Directed**: edges have direction (drawn them with an arrow)
- **Acyclic** : No cycles possible by following arrows in graph

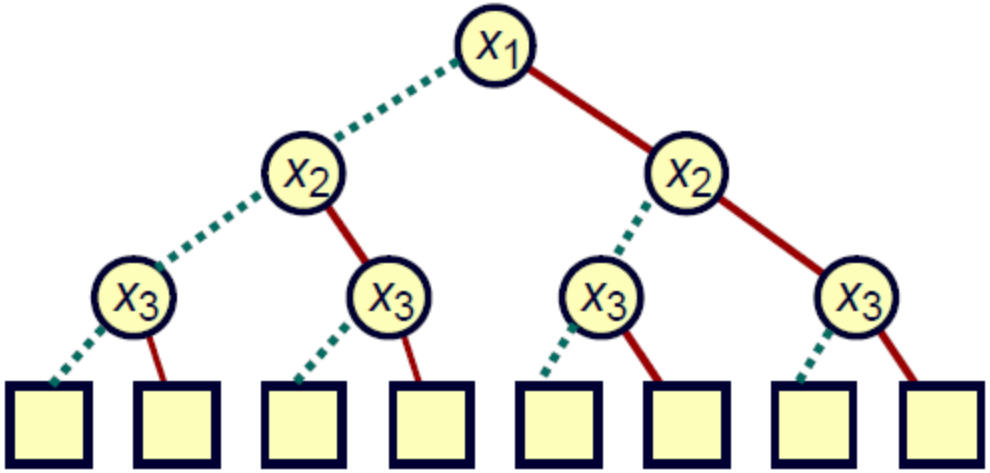
(Often see this shorted to DAG)

BDD

Truth Table

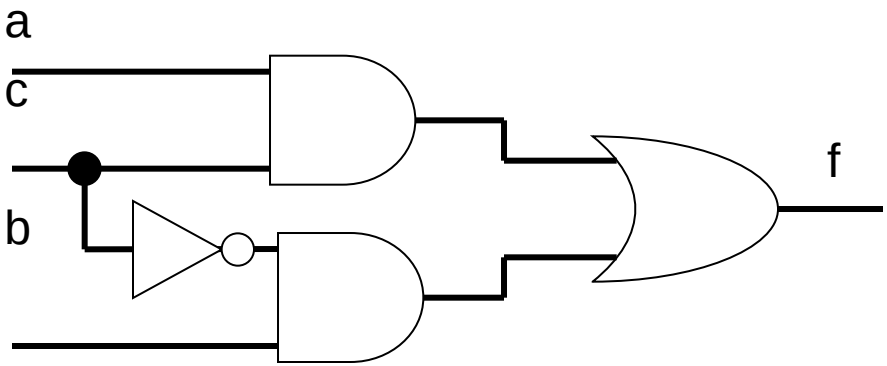
x_1	x_2	x_3	f
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

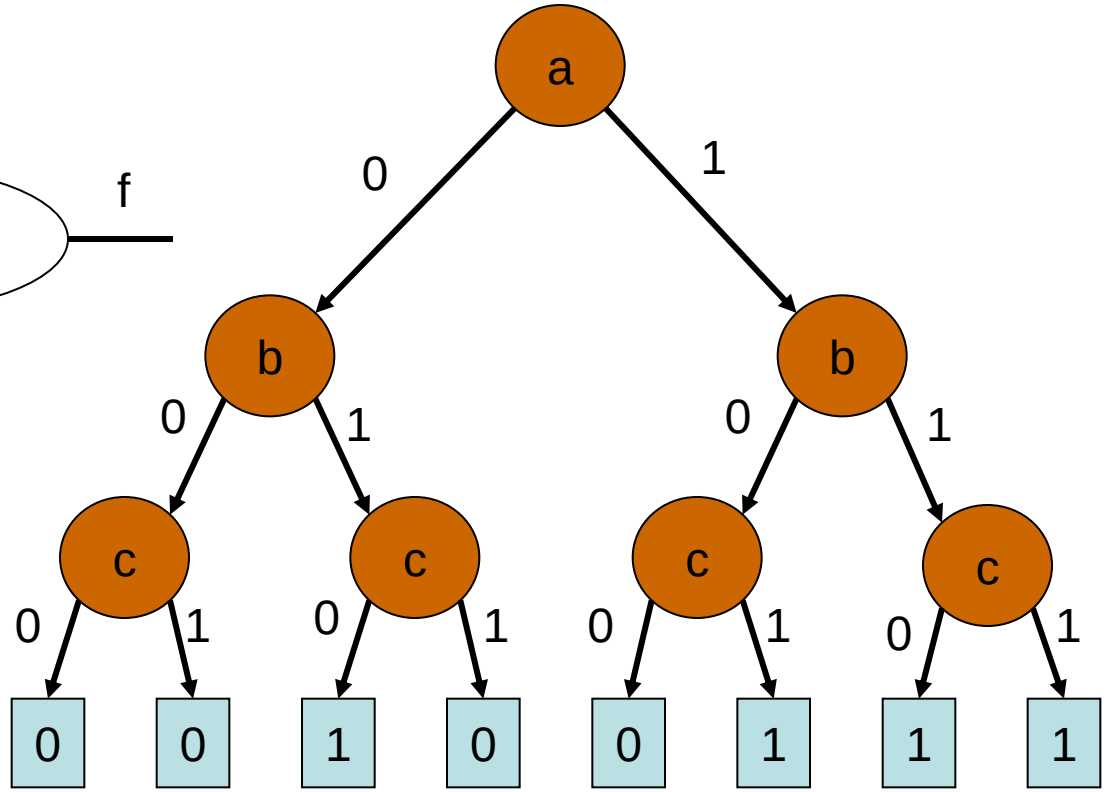
Decision Tree



- Vertex represents a *decision*
- Follow green (dashed) line for value 0
- Follow red (solid) line for value 1
- Function value determined by leaf value.

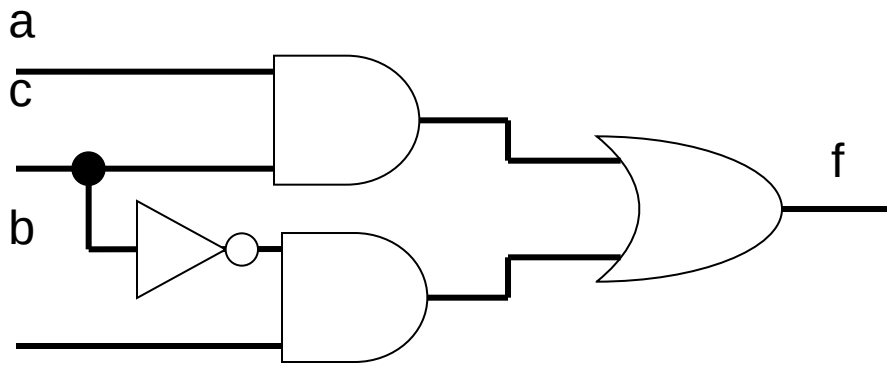
Binary Decision Tree

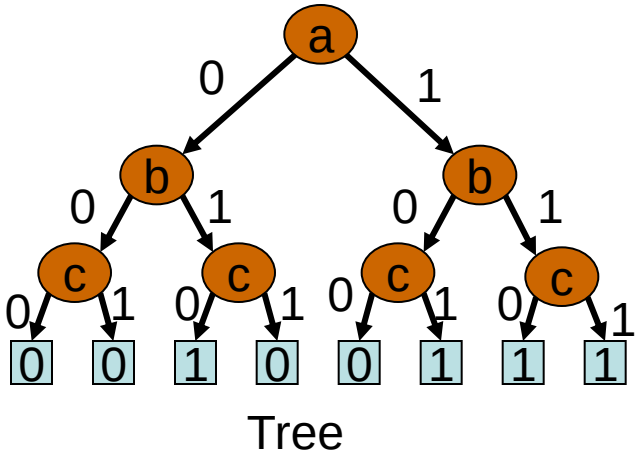




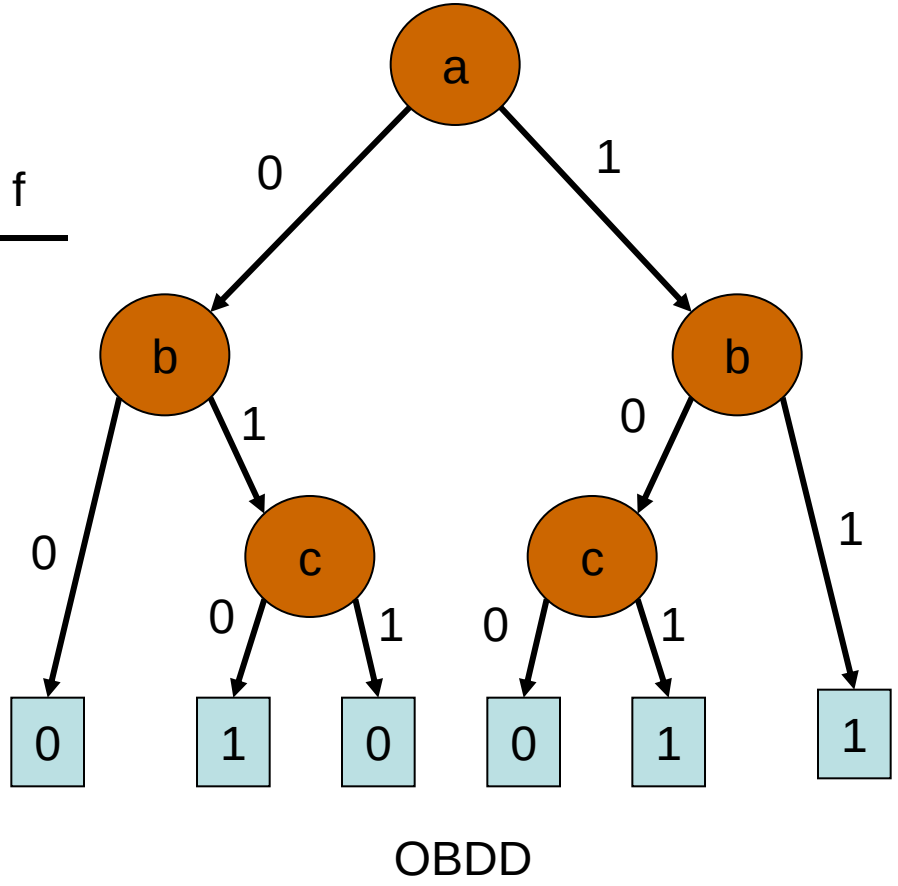
Graph representation of a Boolean function.

Ordered Binary Decision Diagram **(OBDD)**



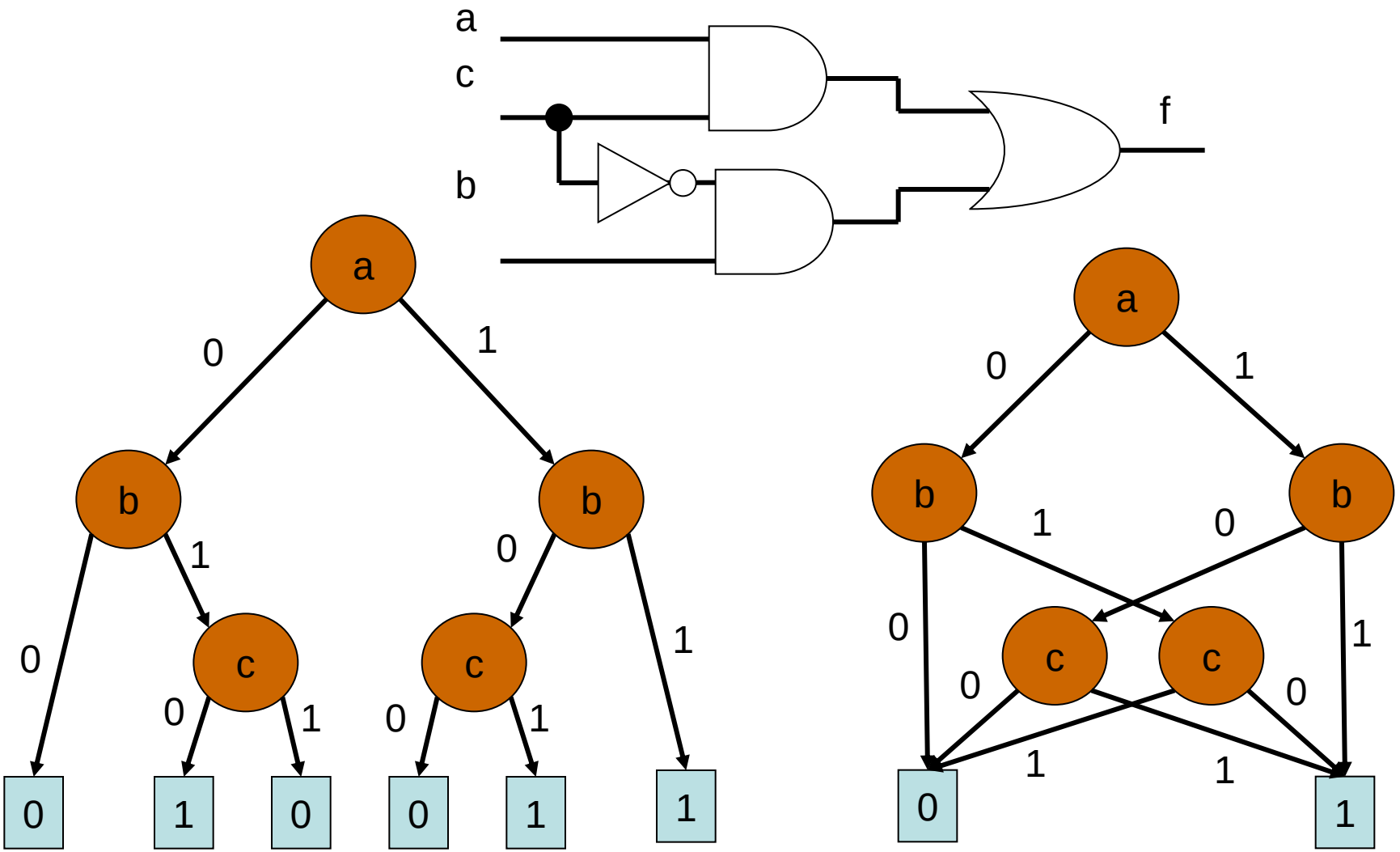


Tree

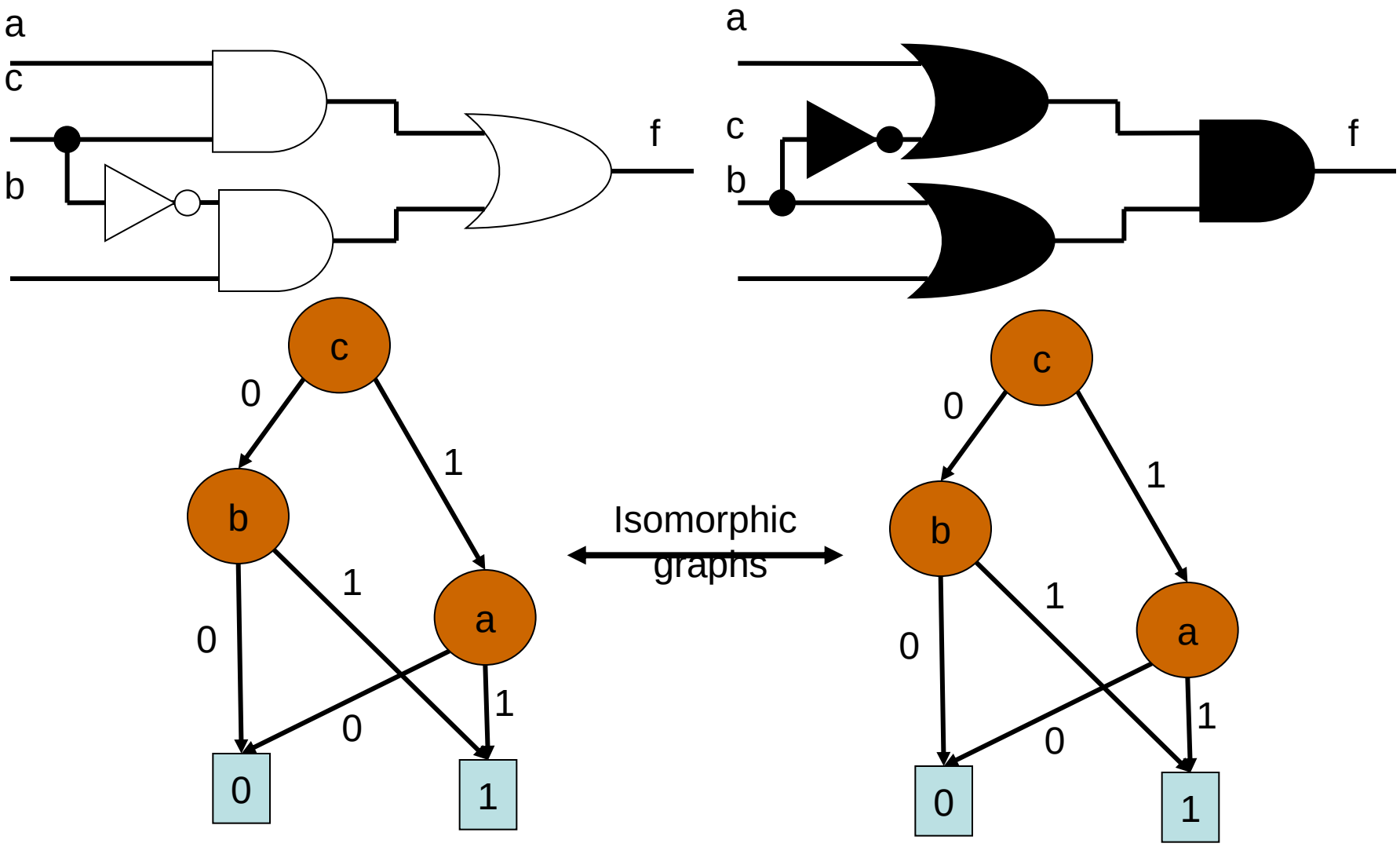


OBDD

Reduction: **OBDD to ROBDD**

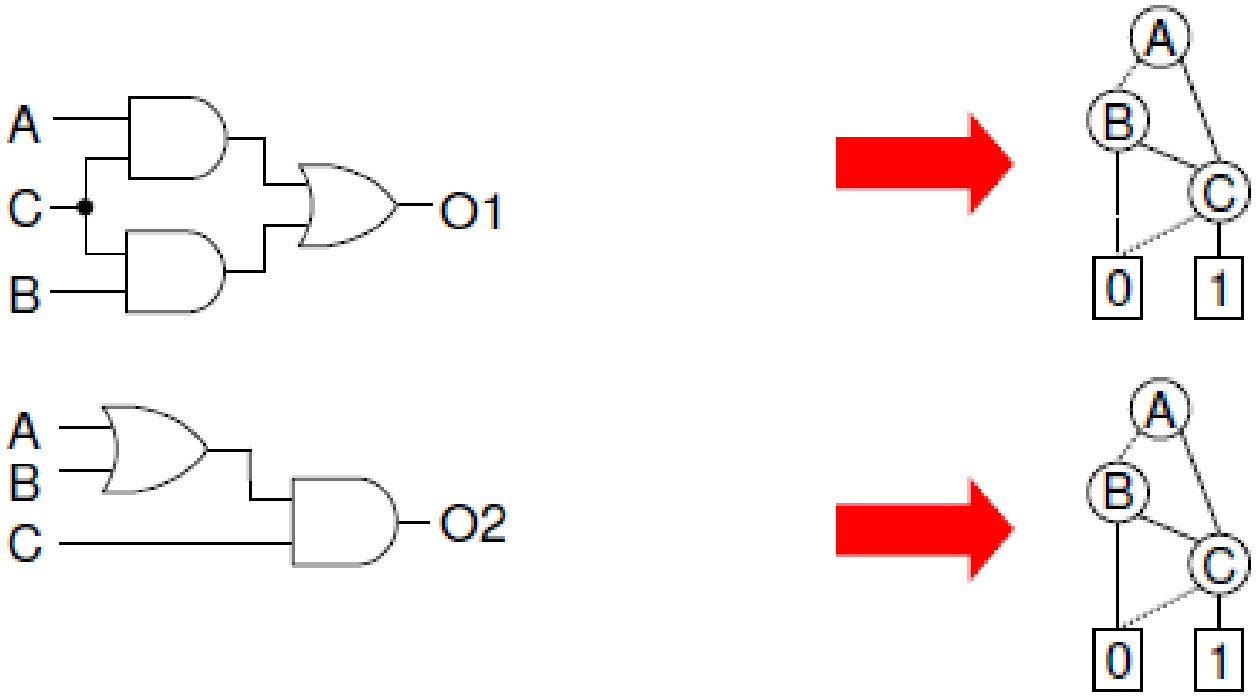


ROBDDs

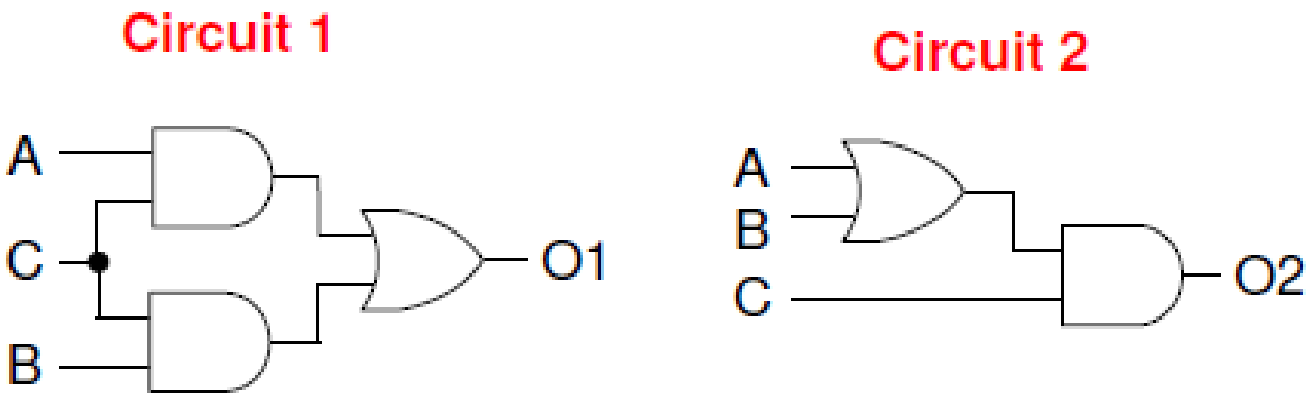


Functions are equal iff ROBDDs identical

Solution using ROBDD



Equivalence Checking Example



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