

Logic Synthesis & Verification

Programming Assignment 1

1. [Using ABC]

- (a) Use BLIF manual

<http://www.eecs.berkeley.edu/~alanmi/publications/other/blif.pdf> to create a BLIF file representing a four-bit adder.

- (b) Perform the following steps to practice using ABC

Command

```
(base) [tp6fu6m3@xdn175o123 abc]$ ./abc
UC Berkeley, ABC 1.01 (compiled Jul  7 2020 12:29:50)
abc 01> read 4bitadder.blif
Hierarchy reader flattened 4 instances of logic boxes and left 0 black boxes.
abc 02> print_stats
4bitadder                : i/o =   9/   5  lat =   0  nd =   14  edge =
v = 4
abc 02> ^C
(base) [tp6fu6m3@xdn175o123 abc]$ ./abc
UC Berkeley, ABC 1.01 (compiled Jul  7 2020 12:29:50)
abc 01> read 4bitadder.blif
Hierarchy reader flattened 4 instances of logic boxes and left 0 black boxes.
abc 02> print_stats
4bitadder                : i/o =   9/   5  lat =   0  nd =   14  edge =
    30  cube =   30  lev = 4
abc 02> show
abc 02> Warning: Missing charsets in String to FontSet conversion

abc 02> strash
abc 03> show
abc 03> Warning: Missing charsets in String to FontSet conversion

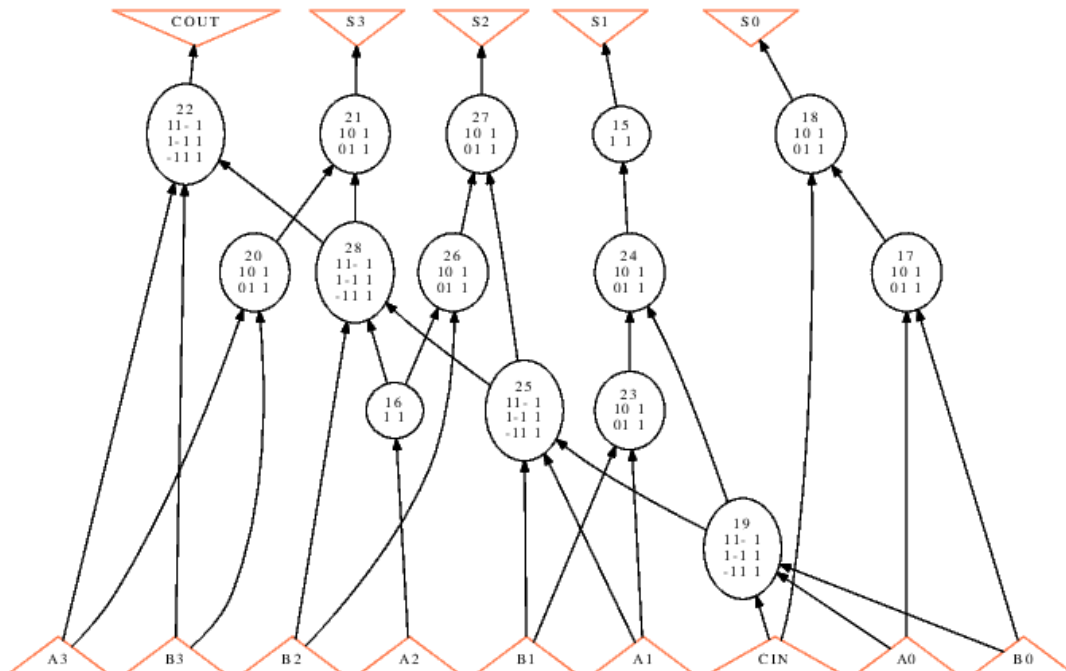
abc 03> collapse
abc 04> show_bdd
abc 04> Warning: Missing charsets in String to FontSet conversion

abc 04> 
```

Logic Network

Network structure visualized by ABC
Benchmark "4bitadder". Time was Thu Oct 15 00:23:34 2020.

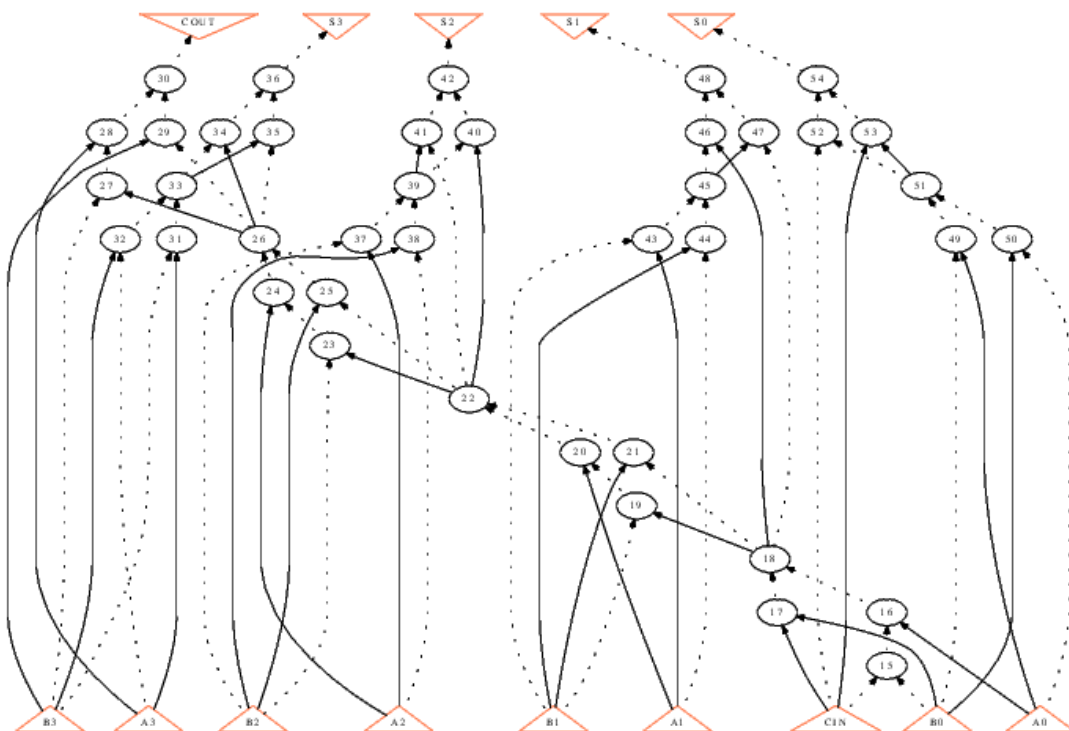
The network contains 14 logic nodes and 0 latches.



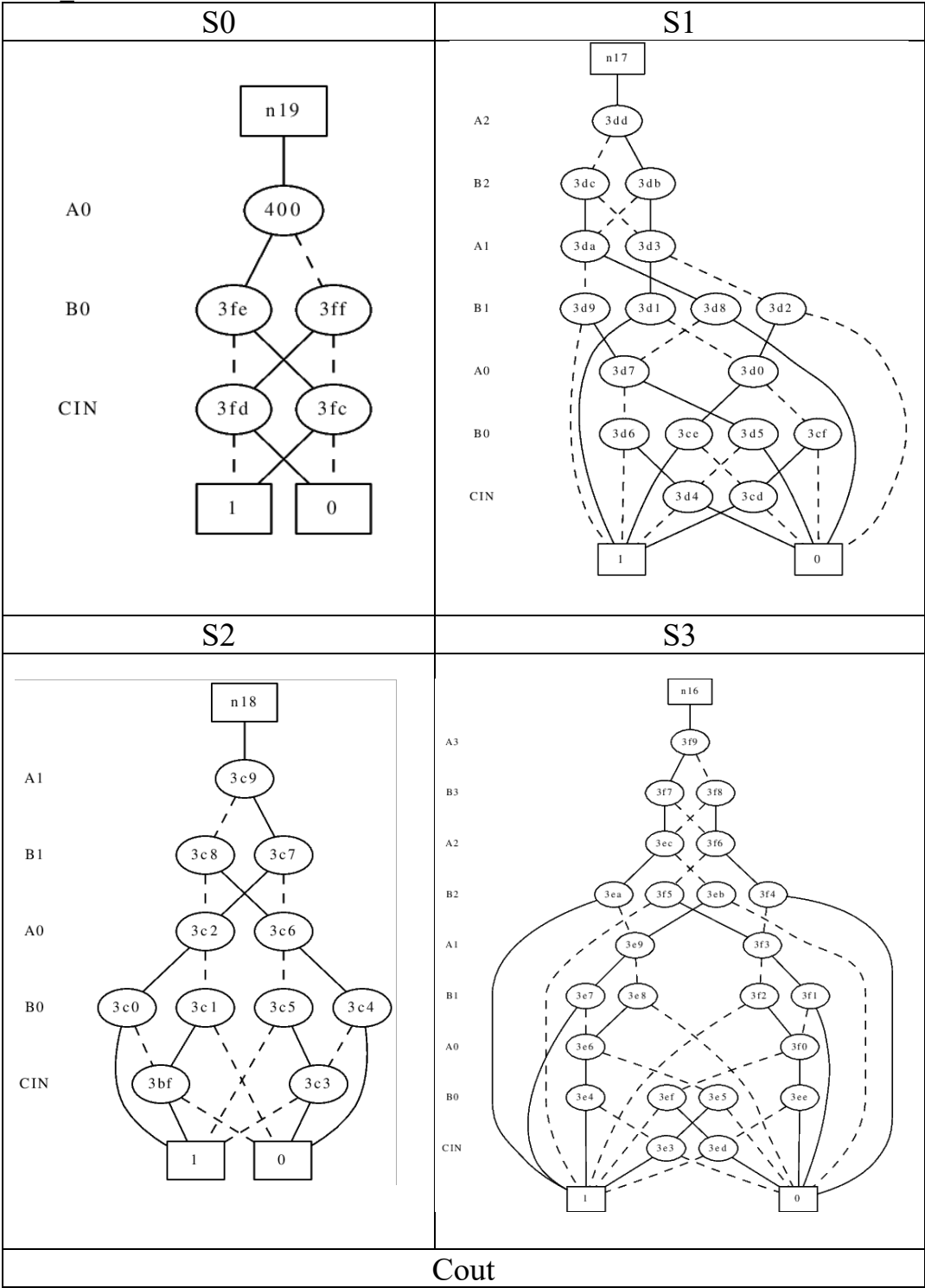
Structurally Hashed Aig

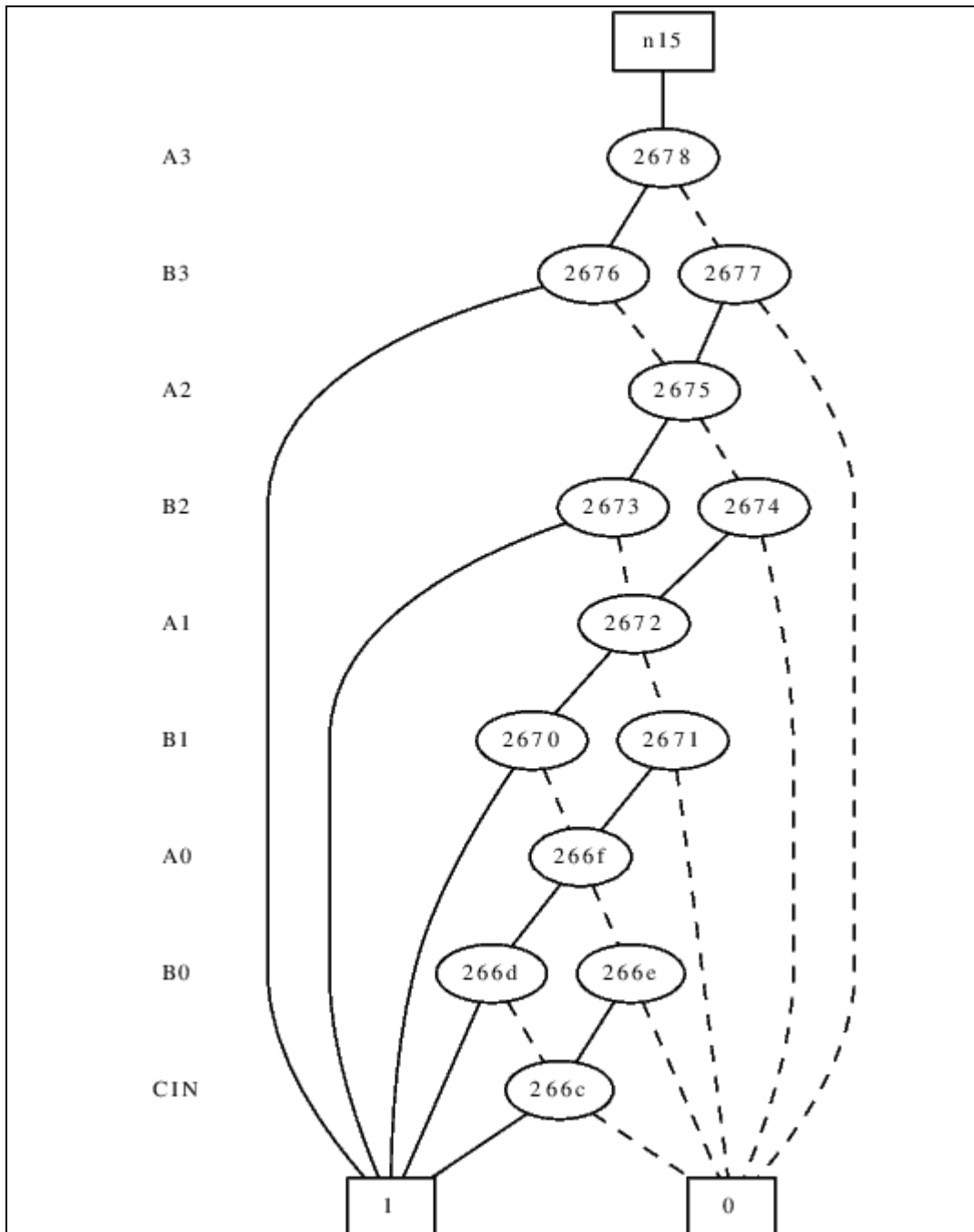
Network structure visualized by ABC
Benchmark "4bitadder". Time was Thu Oct 15 00:30:56 2020.

The network contains 40 logic nodes and 0 latches.



show bdd





2. [ABC Boolean Function Representations]

(a) Please compare the following differences with the four-bit adder example.

1.

logic network in AIG	structurally hashed AIG
Converts local functions of the nodes to AIGs	Transforms the current network into an AIG by one-level structural hashing. The resulting AIG is a logic network composed of two-input AND gates and inverters represented as complemented attributes on the edges. Structural hashing is a purely combinational transformation, which does not modify the number and positions of latches.

2.

logic network in BDD	collapsed BDD
Converts local functions of the nodes to BDDs.	Recursively composes the fanin nodes into the fanout nodes resulting in a network, in which each CO is produced by a node, whose fanins are CIs. Collapsing is performed by building global functions using BDDs and is, therefore, limited to relatively small circuits. After collapsing, the node functions are represented using BDDs.

(b) Given a structurally hashed AIG, please find a sequence of ABC commands to convert it to a logic network in SOP.

By command 'logic'

logic – Transforms the AIG into a logic network with the SOP representation of the two-input AND-gates.