邏輯合成與驗證_HW1 p2&3

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2 [Using ABC] (10%)

(b)

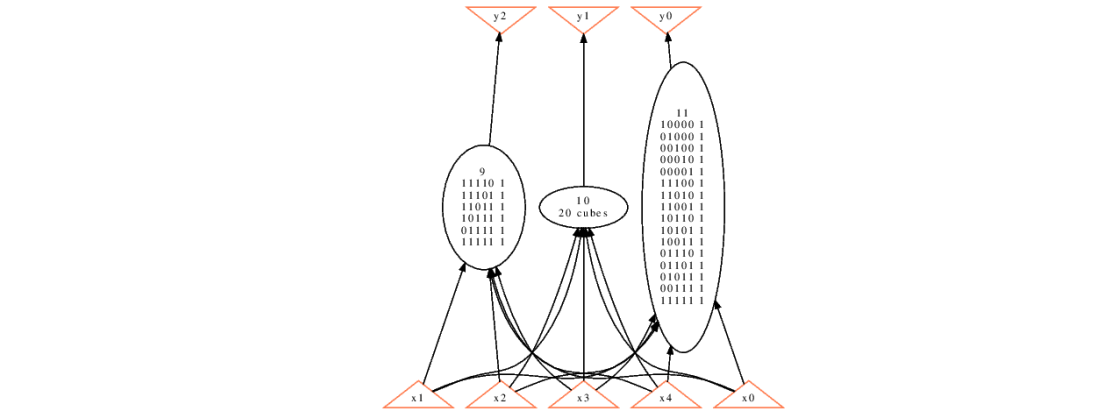
1、2

```
abc 01> read comp.blif
abc 02> print_stats
5-to-3_compressor          : i/o =    5/    3  lat =    0  nd =     3  edge =     15  cube =    42  lev = 1
```

3

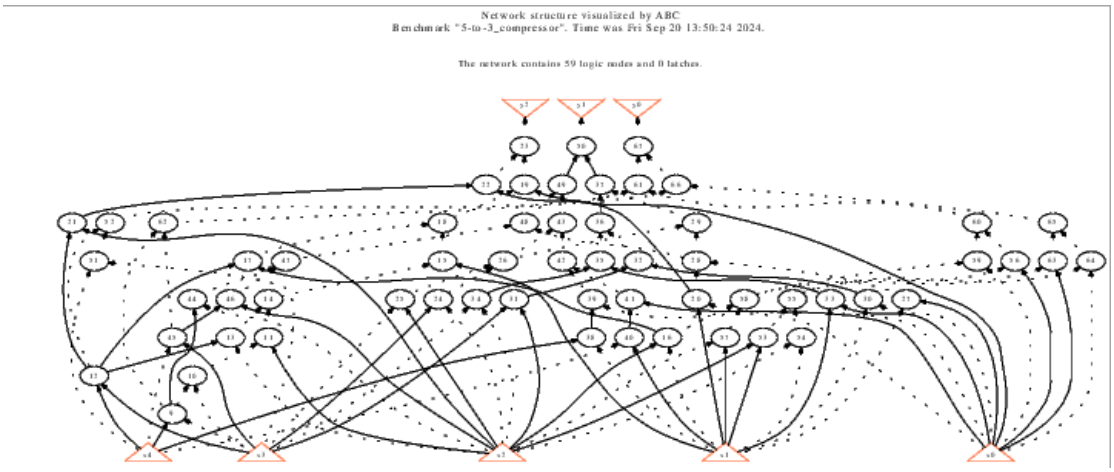
```
abc 02> show
abc 02> Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-140-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-efont-biwidth-medium-r-normal--16-*-*-*-*-*-iso10646-1,-gnu-unifont-medium-r-normal--16-*-*-*-*-*-iso10646-1,-adobe-helvetica-medium-r-normal--14-*-*-*-*-*-*-*,-jis-fixed-medium-r-*-*-16-*-*-*-*-*-jisx0208.1983-0,-*-*-medium-r-*-*-16-*-*-*-*-*-*-*,*" to type FontSet
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-100-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Bold-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct

abc 02>
```



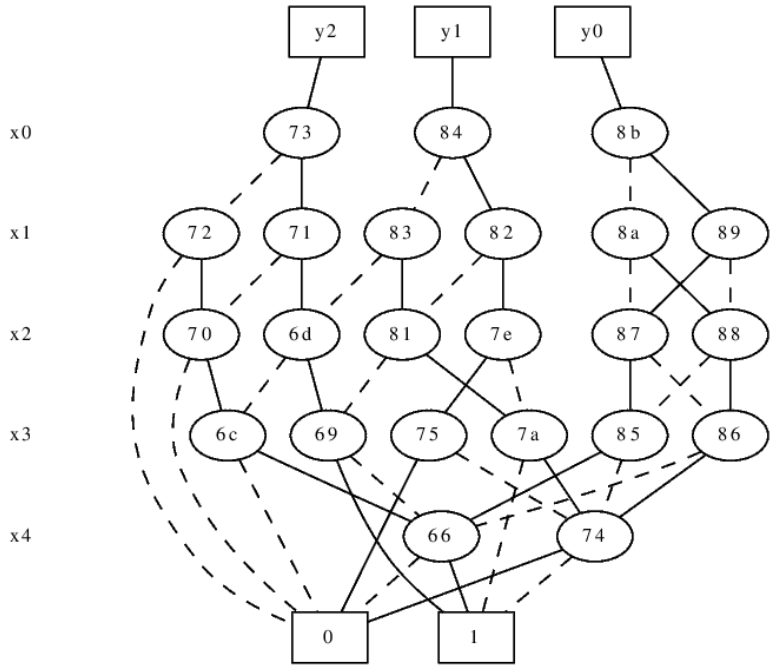
4、5

```
abc 02> strash
abc 03> show
abc 03> Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-140-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-efont-biwidth-medium-r-normal--16-*-*-*-*-*-iso10646-1,-gnu-unifont-medium-r-normal--16-*-*-*-*-*-iso10646-1,-adobe-helvetica-medium-r-normal--14-*-*-*-*-*-*-*,-jis-fixed-medium-r-*-*-16-*-*-*-*-*-jisx0208.1983-0,-*-*-medium-r-*-*-16-*-*-*-*-*-*-*,*" to type FontSet
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-100-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Bold-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
```



6、7

```
abc 03> collapse
abc 04> show_bdd -g
abc 04> Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-140-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-efont-biwidth-medium-r-normal--16-*-*-*-*-*-iso10646-1,-gnu-unifont-medium-r-normal--16-*-*-*-*-*-iso10646-1,-adobe-helvetica-medium-r-normal--14-*-*-*-*-*-*,-jis-fixed-medium-r-*--16-*-*-*-*-*-jisx0208.1983-0,-*-*-medium-r-*--16-*-*-*-*-*-*-*,*" to type FontSet
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-100-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Bold-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
```



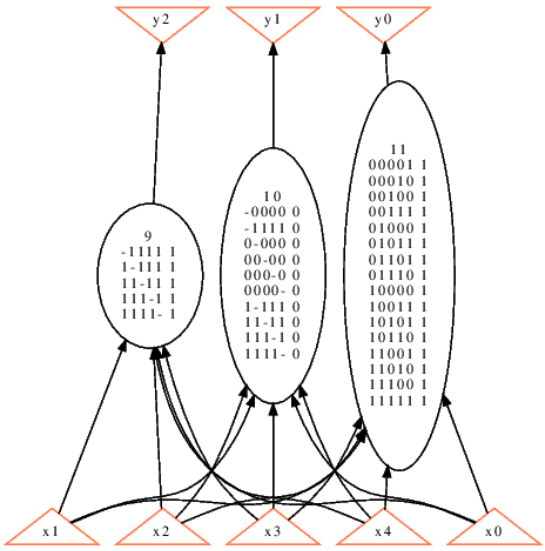
3 [ABC Boolean Function Representations]

(a) 1.

```
abc 01> read comp.blif
abc 02> aig
abc 02> show
abc 02> Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-140-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-efont-biwidth-medium-r-normal--16-*-*-*-*-*-iso10646-1,-gnu-unifont-medium-r-normal--16-*-*-*-*-*-iso10646-1,-adobe-helvetica-medium-r-normal--14-*-*-*-*-*-*,-jis-fixed-medium-r-*--16-*-*-*-*-*-jisx0208.1983-0,-*-*-medium-r-*--16-*-*-*-*-*-*-*,*" to type FontSet
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-100-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Bold-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
```

Network structure visualized by ABC
Benchmark "5-to-3_compressor". Time was Fri Sep 20 14:02:48 2024.

The network contains 3 logic nodes and 0 latches.



Observations：

Compare with the graph we get on question 2, seems that command “aig” does not convert a graph to aig.

```
abc 01> read comp.blif
abc 02> strash
abc 03> print_stats
5-to-3_compressor          : i/o =    5/    3  lat =    0  and =     59  lev =  8
abc 03>
abc 03> read comp.blif
abc 04> aig
abc 04> print_stats
5-to-3_compressor          : i/o =    5/    3  lat =    0  nd =     3  edge =     15  aig  =    65  lev = 1
abc 04>
```

From command print_stats, we can briefly know that command “aig” & “strash” seems to do two totally different things.

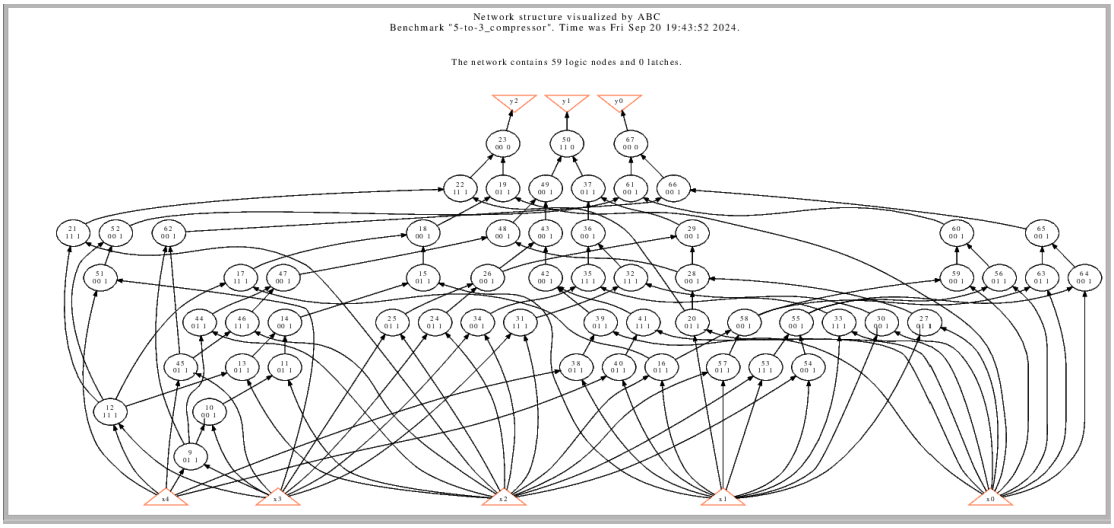
```
abc 01> read comp.blif
abc 02> aig -h
usage: aig [-h]
                converts node functions to AIG
        -h      : print the command usage
```

However, from “aig -h”, it seems that command “aig” should convert node functions to AIG.

I guess that the command “aig” only simplify the node itself while “strash” will break all nodes and form a new AIG graph with same Boolean function. (Pure guess, no evidence support)

2.

```
abc 01> read comp.blif
abc 02> strash
abc 03> bdd
Error: Converting to BDD is possible only for logic networks.
abc 03> logic
abc 04> bdd
abc 04> show
abc 04> Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-140-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-efont-biwidth-medium-r-normal--16-*-*-*-*-*-iso10646-1,-gnu-unifont-medium-r-normal--16
-*-*-*-*-*-iso10646-1,-adobe-helvetica-medium-r-normal--14-*-*-*-*-*-*-*,-jis-fixed-medium-r-*--16-*-*-*-*-*-jisx0208.19
83-0,-*-*-medium-r-*--16-*-*-*-*-*-*-*,*" to type FontSet
Warning: Missing charsets in String to FontSet conversion
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Medium-R-Normal--*-100-*-*-P-*-ISO8859-1" to type FontStruct
Warning: Cannot convert string "-*-Helvetica-Bold-R-Normal--*-120-*-*-P-*-ISO8859-1" to type FontStruct
```



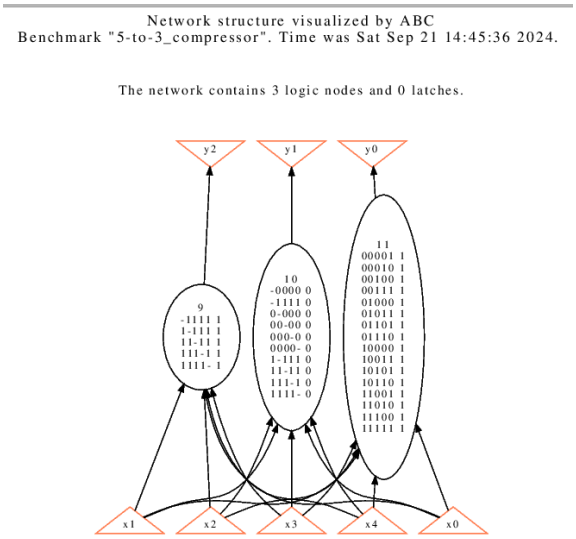
Observation：

Compare to the result get in problem 2, unlike command “collapse”, command “bdd” can’t be done after command “strash” if not using command “logic” before. That is, to use command “bdd”, the network must be a logic circuit. Also, similar to the command “aig”, it did not change the connection between nodes in this network.

(b)

By using the command “collapse”, and then use command “sop”, the graph can be converted into a graph where all outputs has only one fanin whose fanin’s consists only inputs, which can be written as a POS form. Also, command “sop” will convert the node functions in this graph to SOP.

```
abc 01> read comp.blif
abc 02> strash
abc 03> collapse
abc 04> sop
abc 04> print_stats
5-to-3_compressor            : i/o =    5/    3  lat =    0  nd =     3  edge =    15  cube =    31  lev = 1
abc 04> show
```



For the graph I get with my comp.blif, for example, output y2 can be written as $(x2x3x4x5 + x1x3x4x5 + x1x2x4x5 + x1x2x3x5 + x1x2x3x4)$ from the information shown in the node #9.