

## Today

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- Reverse Engineering Example
- 5-Input Design Example
- More Advanced DesignWorks Features

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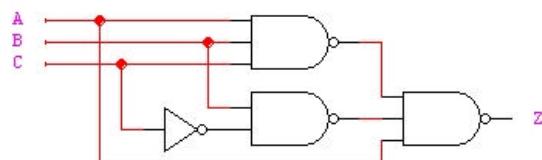
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## Reverse Engineering Example

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- Write down the Boolean expression:



$$f(A, B, C) = \overline{\overline{ABC}} \bullet \overline{\overline{BC}} \bullet A$$

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## Reverse Engineering Ex (cont.)

- Simplify the function using Boolean algebra:

$$\begin{aligned}f(A, B, C) &= \overline{\overline{ABC}} \bullet \overline{\overline{BC}} \bullet A \\&= ABC + B\overline{C} + \overline{A} && \text{DeMorgan's/Involution} \\&= B(AC + \overline{C}) + \overline{A} && \text{Distributive} \\&= B(A + \overline{C}) + \overline{A} && \text{Simplification} \\&= AB + B\overline{C} + \overline{A} && \text{Distributive} \\&= \overline{A} + B + B\overline{C} && \text{Simplification} \\&= \overline{A} + B && \text{Simplification}\end{aligned}$$

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## Reverse Engineering Ex (cont.)

- Write the complete truth table for the circuit.

A	B	C	Z
0	0	0	1
	0	1	1
1	0	0	1
1	1	1	1
1	0	0	0
	0	1	0
1	0	1	1
1	1	1	1

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## Reverse Engineering Ex (cont.)

- Write the canonical SOP form.

$$f(A, B, C) = \overline{ABC} + \overline{ABC} + \overline{ABC} + \overline{ABC} + ABC + ABC$$

$$f(A, B, C) = \sum m(0,1,2,3,6,7)$$

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## Reverse Engineering Ex (cont.)

- Minimize again using a K-map.

$$f(A, B, C) = \sum m(0,1,2,3,6,7)$$

		AB		A	
		00	01	11	10
C	0	1	1	1	0
	1	1	1	1	0

$$f(A, B, C) = \overline{A} + B$$

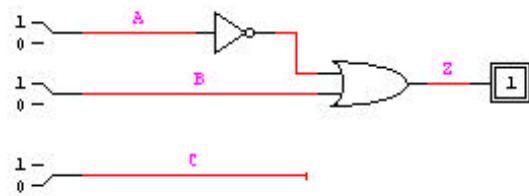
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## Reverse Engineering Ex (cont.)

- Re-implement the better design.



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## 5-Input Design Example

- Consider the following five-input function.

A	B	C	D	E	Z
0	0	0	0	0	1
				1	1
0	0	1	0	0	0
0	1	1	1	0	0
0	1	0	0		1
1	0	1	0	0	0
1	1	0	0	0	0
1	1	1	0	0	0
1	1	1	1	0	0
1	0	0	0	0	1
0	0	1	1	0	1
0	1	0	1	0	1
0	1	1	1	0	0
1	1	0	0	0	1
1	0	1	0	0	0
1	1	0	0	0	0
1	1	1	1	0	0

A	B	C	D	E	Z
1	0	0	0	0	0
				1	1
0	0	1	0	0	1
0	1	0	0	0	0
0	1	1	1	0	0
0	1	0	0		0
0	1	0	0	0	0
1	0	0	0	0	1
1	0	1	0	0	0
1	1	0	0	0	1
1	1	1	0	0	0
1	1	1	1	0	0
1	1	0	0	0	0
0	0	1	1	0	0
0	1	0	1	0	0
0	1	1	0	0	0
1	1	0	0	0	0
1	0	1	0	0	0
1	1	0	0	0	0
1	1	1	1	0	0

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## 5-Input Design Example (cont.)

- Write the canonical SOP form.

$$f(A, B, C, D, E) = \sum m(0, 1, 4, 8, 9, 10, 12, 17, 18, 22, 24, 25)$$

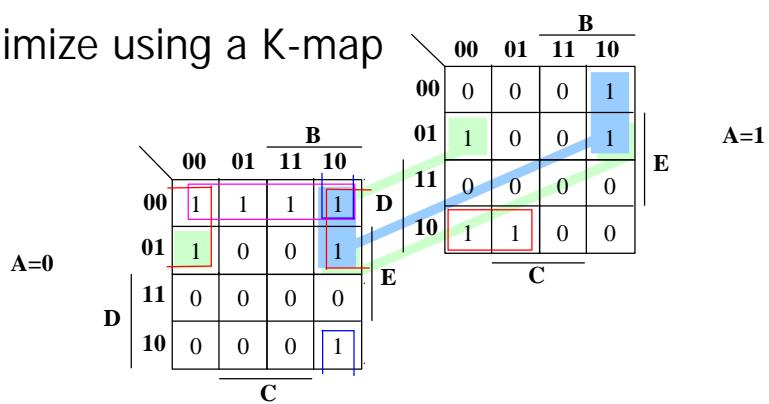
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## 5-Input Design Example (cont.)

- Minimize using a K-map



$$f(A, B, C, D, E) = \overline{ADE} + \overline{ABC}\overline{E} + \overline{ABD}\overline{E} + B\overline{CD} + \overline{C}\overline{DE}$$

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## DesignWorks Powertoys



- Adding your own personal libraries
- Encapsulating your own custom-built parts
- See the online hints page for exact steps to follow.

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