Today

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

Reverse Engineering Example

Write down the Boolean expression:

\[ f(A, B, C) = \overline{ABC} \cdot \overline{BC} \cdot A \]
Reverse Engineering Ex (cont.)

- Simplify the function using Boolean algebra:

\[
f(A, B, C) = ABC \cdot BC \cdot A
\]

\[
= ABC + BC + \overline{A}
\quad \text{Demorgan's/Involution}
\]

\[
= B(AC + \overline{C}) + \overline{A}
\quad \text{Distributive}
\]

\[
= B(A + \overline{C}) + \overline{A}
\quad \text{Simplification}
\]

\[
= AB + B\overline{C} + \overline{A}
\quad \text{Distributive}
\]

\[
= \overline{A} + B + B\overline{C}
\quad \text{Simplification}
\]

\[
= \overline{A} + B
\quad \text{Simplification}
\]

Reverse Engineering Ex (cont.)

- Write the complete truth table for the circuit.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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Reverse Engineering Ex (cont.)

- Write the canonical SOP form.

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

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

Reverse Engineering Ex (cont.)

- Minimize again using a K-map.

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

\[ f(A, B, C) = \overline{A} + B \]
Reverse Engineering Ex (cont.)

- Re-implement the better design.

\[
\begin{array}{c}
1 \\
0 \\
1 \\
0 \\
1 \\
\end{array} \quad \begin{array}{c}
A \\
B \\
E \\
F \\
Z \\
\end{array}
\]

5-Input Design Example

- Consider the following five-input function.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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\[
\begin{array}{c}
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1 \\
\end{array} \quad \begin{array}{c}
A \\
B \\
C \\
D \\
E \\
Z \\
\end{array}
\]
5-Input Design Example (cont.)

- Write the canonical SOP form.

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

5-Input Design Example (cont.)

- Minimize using a K-map

\[ f(A,B,C,D,E) = \overline{ADE} + \overline{ABCE} + \overline{ABDE} + \overline{BCD} + \overline{CDE} \]
DesignWorks Powertoys

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