CME 433 – Lab 1
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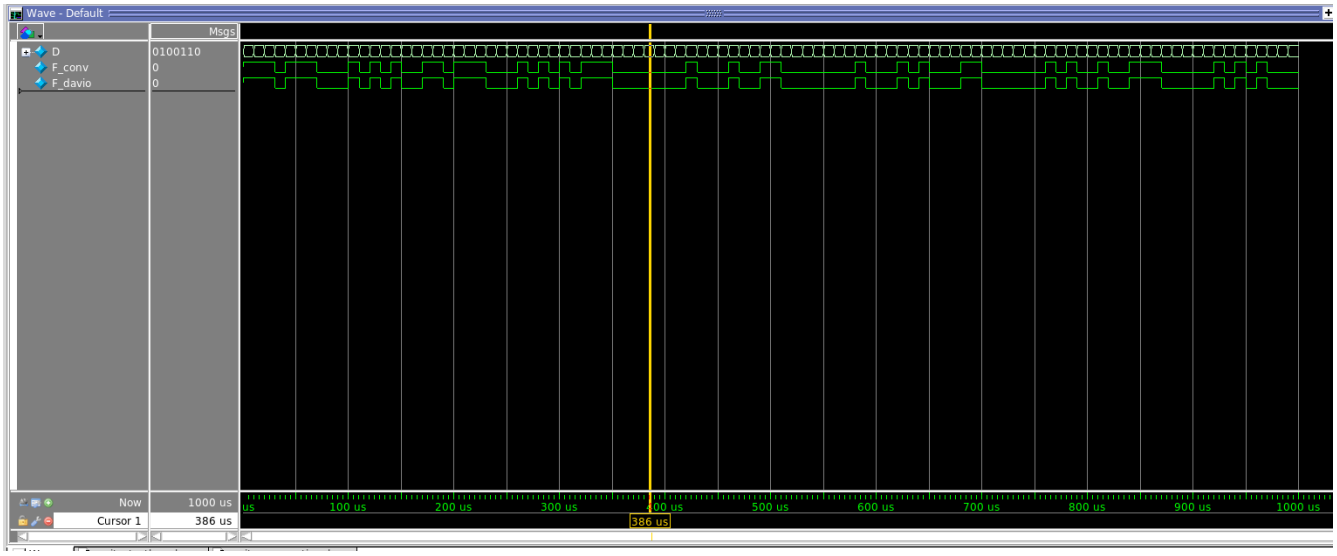
1. CASE statements typically cause the synthesizer to create *binary* or *selector* multiplexers, while the synthesizer will typically create IF/ELSE statements with *priority* multiplexers.

2. Completed the expansion on paper (see attached PDF)

3. Completed verification of the conventional vs davio expansion (see image below)



4.
Shannon-Davio Expansion:
Normal: 7 LE's
Performance(aggressive): 7 LE's
Power: 7 LE's
Area: 7 LE's

Conventional:
Normal: 8 LE's
Performance(aggressive): 8 LE's
Power: 8 LE's
Area: 8 LE's

it appears there was a slight improvement in the davio expansion design, however the Quartus compiler is already too advanced and the different compiler settings yielded no differences within the two designs.

$\bar{X}_0 X_1 X_2 \bar{X}_3 \bar{X}_4 X_5 X_6$

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(1)

2.) Complete Dario expansion of Conventional function they gave

$^{\wedge}0:9, ^{\wedge}1:8, ^{\wedge}2:9, ^{\wedge}3:8, ^{\wedge}4:3, ^{\wedge}5:7, ^{\wedge}6:5$

$$F = \bar{X}_0 X_1 \bar{X}_2 X_3 X_5 \oplus X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_2 \bar{X}_3 \bar{X}_4 \bar{X}_6 \oplus X_0 X_1 X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_3 \oplus \bar{X}_0 X_1 X_3 X_5 \bar{X}_6 \oplus \bar{X}_0 X_2 X_3 X_5 \bar{X}_6 \oplus \bar{X}_0 X_1 X_2 \bar{X}_3 \bar{X}_4 \bar{X}_5 X_6 \oplus \bar{X}_0 X_2 \oplus \bar{X}_0 X_1 \bar{X}_2 \bar{X}_6 \oplus \bar{X}_1 \bar{X}_2 \bar{X}_3 \bar{X}_4$$

→ Solve for f^0_i, f^1_i, f^2_i, then $f = f^0_i \oplus f^2_i$

(f^0_i: Set $x_i := 0$; f^1_i: Set $x_i := 1$; f^2_i: uncommon terms)

If either of these has more than 5 variables, repeat this process on that resultant function

$i = 4$

→ $x_4 = 0$

$$f^0_4 = \bar{X}_0 X_1 \bar{X}_2 X_3 X_5 \oplus X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_2 \bar{X}_3 \bar{X}_6 \oplus X_0 X_1 X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_3 \oplus \bar{X}_0 X_1 X_3 X_5 \bar{X}_6 \oplus \bar{X}_0 X_2 X_3 X_5 \bar{X}_6 \oplus \bar{X}_0 X_1 X_2 \bar{X}_3 \bar{X}_5 X_6 \oplus \bar{X}_0 X_2 \oplus \bar{X}_0 X_1 \bar{X}_2 \bar{X}_6 \oplus \bar{X}_1 \bar{X}_2 \bar{X}_3$$

→ $x_4 = 1$

$$f^1_4 = \bar{X}_0 X_1 \bar{X}_2 X_3 X_5 \oplus X_2 \bar{X}_3 X_5 \oplus X_0 X_1 X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_3 \oplus \bar{X}_0 X_1 X_3 X_5 \bar{X}_6 \oplus \bar{X}_0 X_2 X_3 X_5 \bar{X}_6 \oplus \bar{X}_0 X_2 \oplus \bar{X}_0 X_1 \bar{X}_2 \bar{X}_6$$

$$f^2_4 = X_0 \bar{X}_1 \bar{X}_2 \bar{X}_3 \bar{X}_6 \oplus \bar{X}_0 X_1 X_2 \bar{X}_3 \bar{X}_5 X_6 \oplus \bar{X}_1 \bar{X}_2 \bar{X}_3$$

$F = f^0_4 \oplus 4 f^2_4$ → both have 6 variables → must repeat process

$f^0_4 \Rightarrow f^1$ → $i = 6$

→ $x_6 = 0$

$$f^0_6 = \bar{X}_0 X_1 \bar{X}_2 X_3 X_5 \oplus X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_2 \bar{X}_3 \oplus X_0 X_1 X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_3 \oplus X_0 \bar{X}_1 X_3 X_5 \oplus \bar{X}_0 X_2 X_3 X_5 \oplus \_ \oplus \bar{X}_0 X_2 \oplus \bar{X}_0 X_1 \bar{X}_2 \oplus \bar{X}_1 \bar{X}_2 \bar{X}_3$$

$f_b^{'1} = \bar{X}_0 X_1 \bar{X}_2 X_3 X_5 \oplus X_2 \bar{X}_3 X_5 \oplus X_0 X_1 X_2 \bar{X}_3 X_5 \oplus X_0 \bar{X}_1 \bar{X}_3 \oplus \bar{X}_0 X_1 X_2 \bar{X}_3 \bar{X}_5 \oplus \bar{X}_0 X_2 \oplus \bar{X}_1 \bar{X}_2 \bar{X}_3$

(deleted two)

$f_b^{'2} = X_0 \bar{X}_1 \bar{X}_2 \bar{X}_3 \oplus \bar{X}_0 X_1 X_3 X_5 \oplus \bar{X}_0 X_2 X_3 X_5 \oplus \bar{X}_0 X_1 X_2 X_3 \bar{X}_5 \oplus \bar{X}_0 X_1 \bar{X}_2$

$f' = f_b^{'0} \oplus b f_b^{'2}$ } both only have 5 variables; stop here

$f_4^{'0} = f''$ → $i = 5$

$f_5^{''0} = X_0 \bar{X}_1 \bar{X}_2 \bar{X}_3 \bar{X}_6 \oplus \bar{X}_0 X_1 X_2 \bar{X}_3 X_6 \oplus \bar{X}_1 \bar{X}_2 \bar{X}_3$

$f_5^{''1} = X_0 \bar{X}_1 X_2 \bar{X}_3 \bar{X}_6 \oplus X_5 = 0 \oplus \bar{X}_1 \bar{X}_2 \bar{X}_3$

$f_5^{''2} = \bar{X}_0 X_1 X_2 \bar{X}_3 X_6$

$f'' = f_5^{''0} \oplus 5 f_6^{'0}$ → both have 5 variables; we can stop

$f = f_4^0 \oplus 4 f_4^{'0} = f_6^{'0} \oplus X_6 f_6^{'2} \oplus X_4 \left[f_5^{''0} \oplus X_5 f_5^{''2} \right]$ (original)

target: ep4ce115f29c7, cyclone IV E

→ Made Quartus project

→ Made ModelSim testbench
- new project "parity_testbench" in /.../simulation/modelsim
- libraries: altera_mf, altera_mf_ver, cycloneive_ver
  - → Verified they're the same! ✓

→ just need to try diff optimizations