

**Design Name :** A 3 to 8 Decoder with Invert Input**Objective :**

Learn WITH-SELECT-WHEN concurrent statement in combinatorial circuits.

**Assignment :**

1. A circuit with the following truth table is to be implemented. SWS and Invert are 3 and 1 bit inputs respectively whereas LEDS is an 8 bit output,

Invert	SWS	LEDS	Invert	SWS	LEDS
0	000	00000001	1	000	11111110
0	001	00000010	1	001	11111101
0	010	00000100	1	010	11111011
0	011	00001000	1	011	11110111
0	100	00010000	1	100	11101111
0	101	00100000	1	101	11011111
0	110	01000000	1	110	10111111
0	111	10000000	1	111	01111111

2. Use WITH-SELECT-WHEN to assign appropriate value to the output LEDS.
3. Synthesize your design. Correct if there are errors.
4. Examine RTL-schematics to see if it matches your expectation. Draw RTL schematic in your report.
5. Complete the constraints file by connecting Invert and SWS inputs to switches on FPGA kit. Connect LEDS output to on board LEDs.
6. Implement your design and build binary programming file.
7. Power-up and program your FPGA device through USB cable connection. Check if your design works as desired.
8. Analyze synthesis report and see the resource usage percentages. Put your resource usage (the number of FFs, gates and other stuff) in your report.

**Questionary :**

If you had a chance to design your circuit manually instead of using VHDL what would you change in the circuit? Why? Type your answer in your report.

**Follow Up Work :**

Change your design and use WHEN-ELSEs. Check RTL-schematics see if there are any changes. Type in your comments in the report.

**Homework :**

Add another input to your design. Connect it to one of the push-buttons (South). Let this button reverse the bit order of the output, that is LSB is represented by leftmost LED and MSB is represented by rightmost one.