

Assignment -13

Compiler directives

1. Parameterized Multiplexer (MUX) using Compiler Directives

Design a **2:1 / 4:1 / 8:1 MUX** using compiler directives to control the number of inputs at compile time.

Compiler Directives Used:

- define to set MUX_WIDTH and DATA_WIDTH
- ifdef/elsif to choose number of inputs
- include to modularize macros

Files:

- mux_defines.vh
 - mux.v
 - mux_tb.v
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● 2. Bit-Slice Arithmetic Unit (Adder/Subtractor/Increment)

Implement a small arithmetic unit that performs:

- Add ($a + b$)
- Subtract ($a - b$)
- Increment ($a + 1$)

Controlled using a macro-defined OP selector.

Compiler Directives Used:

- define for operation mode (OP_ADD, OP_SUB, etc.)
- ifdef to compile only selected operations
- Optional include for config reuse

File Plan:

- arithmetic_defines.vh
- bit_arithmetic.v
- arithmetic_tb.v

3. Configurable Comparator Unit

Design a comparator that supports:

- $A == B$
- $A > B$
- $A < B$

Width is macro-defined (e.g., 4, 8, 16-bit comparison).

Compiler Directives Used:

- define for bit-width
- ifdef to enable/disable comparison types
- include for config macros

4. Configurable Priority Encoder

Design a **priority encoder** (e.g., 4-to-2, 8-to-3, 16-to-4), where the **input width** and **output encoding style** are controlled using compiler directives.

Key Features:

- Supports multiple input sizes using define WIDTH.
- Output encoding style (binary/one-hot) selected using define ENCODING.
- Modular and reusable.

◆ Compiler Directives Used:

- define WIDTH 8
- ifdef ENCODING_BINARY, elsif ENCODING_ONEHOT
- Optional debug output controlled by define DEBUG

5. Compile-Time Selectable Logic Block (Gates Block)

Design a **logic block** that can be configured at compile time to behave as:

- AND gate block
- OR gate block
- XOR gate block

Each block takes N inputs (e.g., 4-bit vector), and applies the selected logic operation bitwise.

Compiler Directives Used:

- define GATE_TYPE_AND, GATE_TYPE_OR, etc.
- ifdef GATE_TYPE_AND to activate relevant logic.
- define N 4 for input width.