Project 1

Computer Processors (COMP1212)

This project involves implementing components of a computer processor covered in the videos. You should provide an implementation of each of the following components in hdl. You are provided with a description of the behaviour of each of the components as well as test files to ensure it behaves according to specification.

Implement the following .hdl files

- And.hdl

- Or.hdl

- Not.hdl

- Xor.hdl

- Mux.hdl

- DMux.hdl

- And16.hdl

- Or16.hdl

- Not16.hdl

- Mux16.hdl

- Or8Way.hdl

- Mux4Way16.hdl

- Mux8Way16.hdl

- DMux4Way.hdl

- DMux8Way.hdl

Chip descriptions

Chip name: And

Inputs: x, y

Outputs: out

Function: out $= 1$ if $(x == 1$ and $y == 1)$ 0 otherwise

Chip name: Or

Inputs: x, y

Outputs: out

Function: out $= 1$ if $(x == 1$ or $y == 1)$ 0 otherwise

Chip name: Not

Inputs: x

Outputs: out

Function: out $=$ not x

Chip name: Xor

Inputs: x, y

Outputs: out

Function: out $=$ not $(x == y)$

Chip name: `Mux`

Inputs: x, y, sel

Outputs: out

Function: If sel $== 1$ then out $= y$ else out$= x$

Chip name: `DMux`

Inputs: in, sel

Outputs: x, y

Function: $\{x, y\} = \{in, 0\}$ if sel $== 0$ $\{0, in\}$ if sel $== 1$

Chip name: `And16`

Inputs: $x[16], y[16]$

Outputs: out$[16]$

Function: For $i = 0 \ldots 15$ out$[i] = x[i]$ and $y[i]$

Chip name: `Or16`

Inputs: $x[16], y[16]$

Outputs: out$[16]$

Function: For $i = 0 \ldots 15$ out$[i] = x[i]$ or $y[i]$

Chip name: Not16

Inputs: $x[16]$

Outputs: out[16]

Function: For $i = 0 \ldots 15$ out[i] $=$ not $x[i]$

Chip name: Mux16

Inputs: $x[16], y[16], \text{sel}$

Outputs: out[16]

Function: If sel $== 1$ then out $= y$ else out $= x$

Chip name: Or8Way

Inputs: $x[8]$

Outputs: out

Function: out $= x[0]$ or $x[1]$ or $\ldots$ or $x[7]$

Chip name: `Mux4Way16`

Inputs: $w[16], x[16], y[16], z[16], sel[2]$

Outputs: out[16]

Function: out $= w$ if sel $== 00$
$\quad x$ if sel $== 01$
$\quad y$ if sel $== 10$
$\quad z$ if sel $== 11$

Chip name: `Mux8Way16`

Inputs: $s[16], t[16], u[16], v[16], w[16], x[16], y[16], z[16], sel[3]$

Outputs: out[16]

Function: out $= s$ if sel $== 000$
$\quad t$ if sel $== 001$
$\quad u$ if sel $== 010$
$\quad v$ if sel $== 011$
$\quad w$ if sel $== 100$
$\quad x$ if sel $== 101$
$\quad y$ if sel $== 110$
$\quad z$ if sel $== 111$

Chip name: `DMux4Way`

Inputs: $in, \text{sel}[2]$

Outputs: w, x, y, z

Function: $(w, x, y, z) = (in, 0, 0, 0)$ if sel $== 00$
$(0, in, 0, 0)$ if sel $== 01$
$(0, 0, in, 0)$ if sel $== 10$
$(0, 0, 0, in)$ if sel $== 11$

Chip name: `DMux8Way`

Inputs: $in, \text{sel}[2]$

Outputs: s, t, u, v, w, x, y, z

Function: $(s, t, u, v, w, x, y, z) =$
$(in, 0, 0, 0, 0, 0, 0, 0)$ if sel $== 000$
$(0, in, 0, 0, 0, 0, 0, 0)$ if sel $== 001$
etc.
$(0, 0, 0, 0, 0, 0, 0, in)$ if sel $== 111$