# CS232 Week2 Q1

Vedang Dhirendra Asgaonkar (200050154)

January 2022

## 1 Design

### 1.1 MUX Design

The MUX has three input ports $x_0, x_1, s$ and one output port $o$. It uses $s$ as a switch on the inputs. In terms of Boolean algebra, it is implemented as

$$o = (x_1 \cdot s) + (x_0 \cdot \bar{s})$$

### 1.2 Encoder design

We convert each of the three outputs into its Reduced Ordered Binary Decision Diagram (ROBDD). Every node of the ROBDD can be converted into a MUX with the corresponding variable as its signal $s$. The port $x_0$ of the MUX will recieve the signal from the negative side of the node and $x_1$ from the positive side. The enabler can be finally connected to the $s$ of a MUX, taking $x_0$ connected to $\mathbf{0}$ and $x_1$ to the output for each output. We construct the circuit as follows

$$\begin{aligned}
z_0 &= i_1 + i_3 + i_5 + i_7 \\
z_0 &= M(\mathbf{0}, M(M(M(M(\mathbf{0}, \mathbf{1}, i_1), \mathbf{1}, i_3), \mathbf{1}, i_5), \mathbf{1}, i_7), en) \\
z_1 &= i_2 + i_3 + i_6 + i_7 \\
z_1 &= M(\mathbf{0}, M(M(M(M(\mathbf{0}, \mathbf{1}, i_2), \mathbf{1}, i_3), \mathbf{1}, i_6), \mathbf{1}, i_7), en) \\
z_2 &= i_4 + i_5 + i_6 + i_7 \\
z_2 &= M(\mathbf{0}, M(M(M(M(\mathbf{0}, \mathbf{1}, i_4), \mathbf{1}, i_5), \mathbf{1}, i_6), \mathbf{1}, i_7), en) \\
&\text{where, for MUX} \\
o &= M(x_0, x_1, s)
\end{aligned}$$