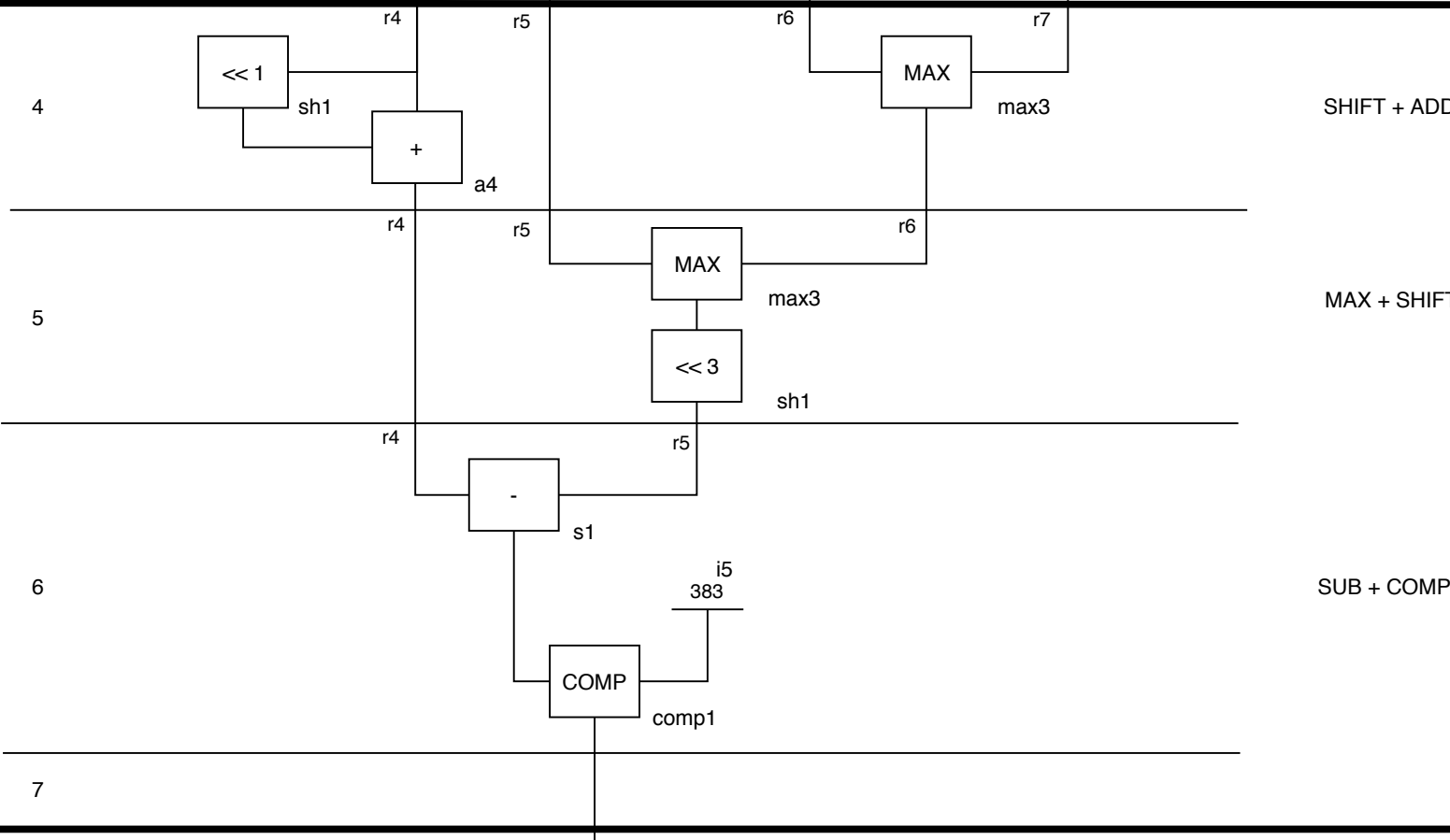
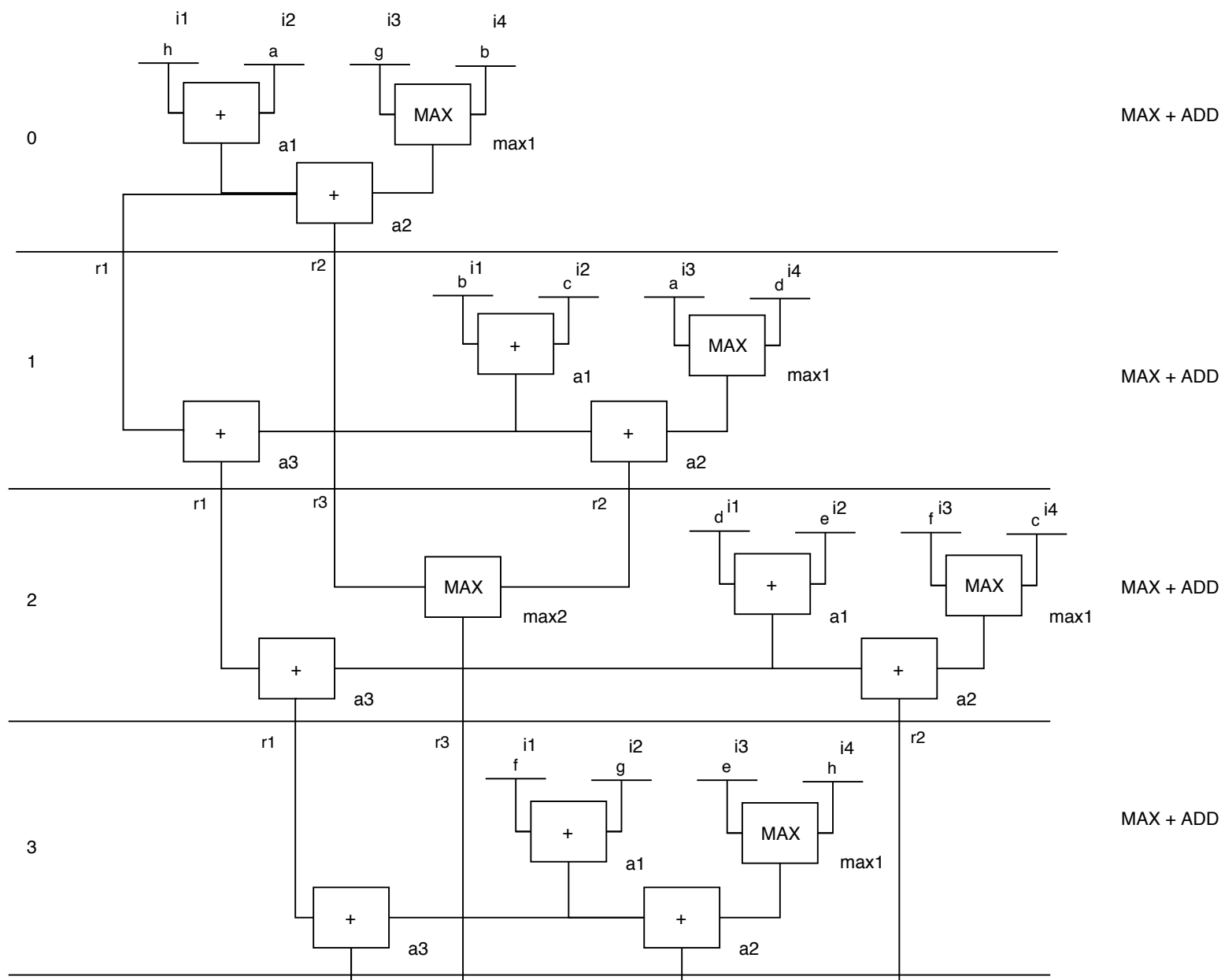


1



2

Number of Components

ADD : 4 COMP : 1
MAX : 3 SHIFT : 1
SUB : 1 REG : 7

Throughput : $\min(1/4, 1/4) = 1/4$

Latency : 8

Equation:

$$\max(\text{ALL}) = 8 * (\max(\max((h + a) + \max(g, b)), ((b + c) + \max(a, d))), \max(((d + e) + \max(f, c)), (f + g) + \max(e, h)))) - 3 * z$$

We obtained the optimized equation with the following steps:

1. Applied the " $5a - 3b = 8a - 3(a + b)$ " optimization to all equations (of each direction)
2. Applied the " $\max(a - c, b - c) = \max(a, b) - c$ " optimization to pairs of equations e.g N, NW
3. Applied the " $\max(a + b, b + c) = b + \max(a, c)$ " to the same pairs of equations as step 2 e.g N, NW

4. Then found the max of the first 4 directions,
 $\max(W, NW, N, NE) = 8 * \max(((h + a) + \max(g, b)), ((b + c) + \max(a, d))) - 3 * z$

5. Then found the max of the remaining 4 directions,
 $\max(E, SE, S, SW) = 8 * \max(((d + e) + \max(f, c)), (f + g) + \max(e, h))) - 3 * z$

6. Then combined equations from steps 4 and 5 to obtain
 $\max(\text{ALL}) = 8 * (\max(\max(((h + a) + \max(g, b)), ((b + c) + \max(a, d))), \max(((d + e) + \max(f, c)), (f + g) + \max(e, h)))) - 3 * z$

The final step would then be to check if max is greater than 383, and then return o_edge from the result

$$\text{ClockPeriod} = \# \text{Components_maxClockPeriod} * \text{TotalDelay}$$

$$\text{ClockPeriod} = \text{Max} * \text{TotalDelay} + \text{Add} * \text{TotalDelay} + \text{Flop} * \text{TotalDelay}$$

$$\text{ClockPeriod} = 1 * 2.55 + 1 * 2.3 + 1 * 0.86$$

$$\text{ClockPeriod} = 5.71 \text{ ns}$$

$$\text{ClockSpeed} = 1 / \text{ClockPeriod} = 175.13 \text{ MHz}$$

To calculate clock speed, we assumed 9 bits and 2 muxes to get the upper bound.

$$\text{Area} = \# \text{ADD} * \# \text{LUTs} + \# \text{MAX} * \# \text{LUTs} + \# \text{SUB} * \# \text{LUTs} + \# \text{COMP} * \# \text{LUTs} + \# \text{SHIFT} * \# \text{LUTs} + \# \text{REG} * \# \text{LUTs}$$

$$\text{Area} = 4 * 18 + 3 * 22 + 1 * 18 + 3 * 22 + 1 * 0 + 7 * 1$$

$$\text{Area} = 229$$

$$\text{Area} \sim 250$$

To calculate the area, we assumed 9 bits and 2 muxes to get the upper bound. The area was then rounded up to 250 to account for reading and writing

Finally, using the values from above, the optimality of the system can be determined. The functionality is set to 1000 as we are assuming full functionality

$$\text{Optimality} = \text{Functionality} * \text{ClockSpeed} / \text{Area}$$

$$\text{Optimality} = 1000 * 175.13 / 250$$

$$\text{Optimality} = 700.52$$

$$\text{Optimality} \sim 70\%$$