DIGITAL LOGIC SYSTEMS - SPRING 2019
PROJECT 2: PRIORITY ENCODER

Deadline: 20:00 Wednesday 15th May, 2019

Specifications

A priority encoder with input length 2^n is defined as follows.

Input: $y[2^n - 1 : 0] \in \{0,1\}^{2^n}$
Output: $x[n-1:0] \in \{0,1\}^n$, $valid \in \{0,1\}$
Functionality:

$valid = 1 \iff y \neq 0^{2^n}$.

Let i denote the largest index i such that $y[i] = 1$. If $valid = 1$, then $\vec{x}$ should satisfy $\langle \vec{x} \rangle = i$.

Formally:

$$\vec{y} \neq 0^{2^n} \implies y\left[2^n - 1 : \langle \vec{x} \rangle\right] = 0^{2^n - 1 - \langle \vec{x} \rangle} \circ 1$$

Your Assignment

(1) Complete the circuit `penc(4)` from the template `template_penc.circ` to implement a priority encoder with an input length of 16.
(2) You *may not* use the priority encoder provided by Logisim.
(3) Your design must be recursive. (Hint: apply divide-and-conquer and use the `valid` output as a selector to choose which of the sub-encoders should be considered.)

Submission Instructions

(1) Submit a single Logisim (".circ") file. No prints/screenshots. This file must be named `ID1_ID2_penc.circ` with `ID1` and `ID2` replaced by each partner's 9 digit ID number.
(2) Use the provided `template_penc.circ` file as a template, and implement your designs in the circuit named `penc`. Do not move or modify the input/output ports, the "blackbox" layout, and the names of the circuits!
(3) Only one of the students in a pair needs to upload the submission. Do not upload the same work twice!
(4) You may not use gates with fan-in larger than 2.