

## 11 Dataflow [30 points]

- We define the *switch node* in Figure 3 to have 2 inputs (**I**, **Ctrl**) and 1 output (**O**). The *Ctrl* input always enters perpendicularly to the switch node. If the *Ctrl* input has a *True* token (i.e., a token with a value of 1), the **O** wire propagates the value on the **I** wire. Else, the 2 input tokens (**I**, **Ctrl**) are consumed, and no token is generated at the output (**O**).
- We define the *inverter node* in Figure 4 to have 1 input (**I**) and 1 output (**O**). The node negates the input token (i.e.,  $O = !I$ ).
- We define the *TF node* in Figure 5 to have 3 inputs ( $I_F$ ,  $I_T$ , **Ctrl**) and 1 output (**O**). When **Ctrl** is set to *True*, **O** takes  $I_T$ . When **Ctrl** is set to *False*, **O** takes  $I_F$ .
- The  $\geq$  node outputs *True* only when the left input is greater than or equal to the right input.
- The  $+1$  node outputs the input plus one.
- The  $+$  node outputs the sum of the two inputs.
- A node generates an output token when tokens exist at *every* input, and *all* input tokens are consumed.
- Where a single wire splits into multiple wires, the token travelling on the wire is replicated to all wires.

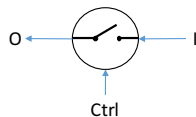


Figure 3: Switch Node

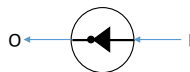


Figure 4: Inverter Node

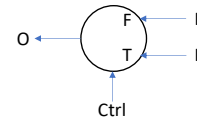


Figure 5: TF Node

Consider the dataflow graph on the following page. Numbers in dashed boxes represent tokens (with the value indicated by the number) in the initial state. The **X** and **Y** inputs automatically produce tokens as soon as the previous token on the wire is consumed. The order of these tokens follows the pattern (*note, the following are all single digit values spaced appropriately for the reader to easily notice the pattern*):

**X**: 0 01 011 0111 01111

**Y**: 1 22 333 4444 55555

Consider the dataflow graph on the following page. Please clearly describe the sequence of tokens generated at the output (OUT).

1, 4, 9, 16, 25

