Exercise 5.1.

Design a register machine to compute factorial using the iterative algorithm specified by the following procedure. Draw data-path and controller diagrams for this machine.

Answer.

A machine to carry out this factorial algorithm must keep track of two numbers, product and counter, and we assume that these numbers are stored in two registers with those names. The basic operation required are testing whether contents of register counter exceeds the constant n, computing the product of the contents of register counter multiplied by the contents of register product, and computing the increment of the contents of register counter. On each cycle of the factorial algorithm, the contents of register product must be replaced by the product produced by multiplied itself to the contents of register counter, and the contents of register counter must be replaced by its increment. Figure 1 shows the data-path diagram for this machine, and figure 2 decribes its controller respectively.

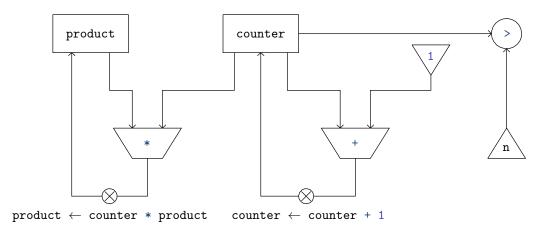


Figure 1. Data paths for a factorial machine.

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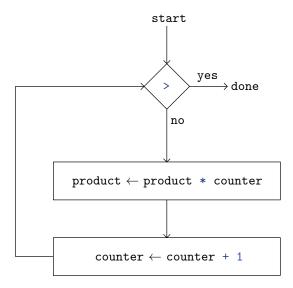


Figure 2. Controller for a factorial machine.