HW 4; Due September 30th

E85 – Fall 2015

Please turn in 3 parts: A, B and C as separated documents (stapled or paper clipped etc.). Put your name on all pages.

Part A (35%):
3.3, 3.5

Part B (35%):
3.26, 3.31

Part C (30%):
See next page.

Credit on these comes largely from you clearly explaining your design choice and advantages and disadvantages of it, rather than finding an absolutely optimal design.
Part C (30%):

A sizable fraction of the water supply for Los Angeles comes from the Owens Valley and Mono Lake basin. The initial aqueduct was completed in 1913. Where aqueducts cross mountains there is potential energy available in the form of the water falling. This can be utilized to generate electricity or water pressure (normally used to ascend the next mountain). An example of the former is the so called terminal structure in Sylmar, CA, it consists of a penstock (generates power) and a cascade structure (generates no power).

Water from the terminal structure flows into the Upper Van Norman Reservoir, before supplying water to LA. This reservoir serves as a buffer for water demand. It of course has a maximum holding capacity.

You may assume you can measure the water level in the Upper Van Norman Reservoir as a 4-bit unsigned number. You may also measure the outflow from the Upper Van Norman Reservoir as a 4-bit unsigned number. Let the maximum outflow rate from the reservoir be $I_{\text{Max}}$. The flow rate in both the penstock and cascade can be set as a 4-bit unsigned number. The maximum flow through the penstock is $I_{\text{Max}}/4$. The maximum flow rate through the cascade is $I_{\text{Max}}$. Let the capacity of the reservoir be 2 days at $I_{\text{Max}}$.

Design a finite state machine that maintains water availability while allowing for maintenance and power recovery. To allow for maintenance, your system must have the ability to manually set the flow rate in the penstock and cascade to 0. A clock is available of any frequency you wish. You may also assume you have a comparison circuit available that takes two 4-bit numbers and returns if $A < B$ as its output (if $A < B$ than output = 1; otherwise 0). Show one or more state transition diagrams for your design. Clearly define the inputs, outputs and internal variables/states of your machine and explain its operation.