Bilkent University, EEE 102 Digital Design 2nd Midterm Exam

Each question must be solved on a separate blank sheet. . On top of each sheet, you must write and sign the following honor code:

On my honor, I have neither given nor received unauthorized aid on this exam question

Your full name: **Your signature:**

Questions solved without a signed honor code **will not be graded. Solutions must be hand written. Typed solutions will not be graded.**

Question 4 [25 pts]

Consider a device with two single bit inputs, S and W; one clock, CLK; and two bits output, Y = (Y1 Y0). When S=1 the value of Y is incremented by W in a modular fashion, i.e.,

$$Y = (Y+W) \bmod 4.$$

Note that Y has unsigned representation. When S=0, we have (Y1 Y0) = (Y0 W), i.e., shift operation is performed with W as the shift input.

(i) Draw the state transition diagram of the Moore machine that solves this problem using minimum number of states. [15 pts]

(ii) Assuming that we start from Y=00, which inputs should be applied in sequence to reach to state Y=11 in as few clock cycles as possible? Draw the timing diagram for this case. [10 pts]