Assignment 3

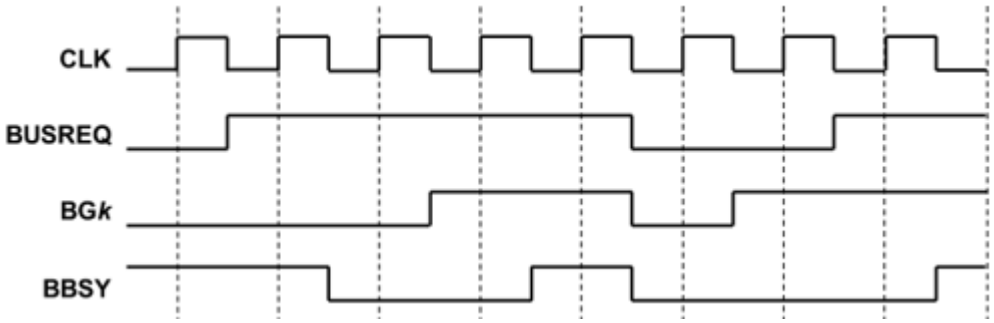
Due October 18, 23:59

NOTE: Late submissions will not be accepted. Please submit a single PDF file with your answers via the **ECE 355 Brightspace** webpage.

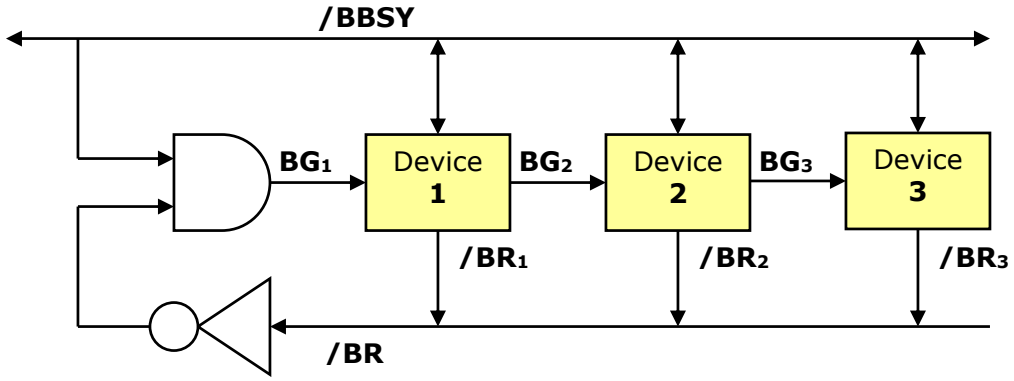
1. [10 points] Solve Problem **7.11** from the textbook.

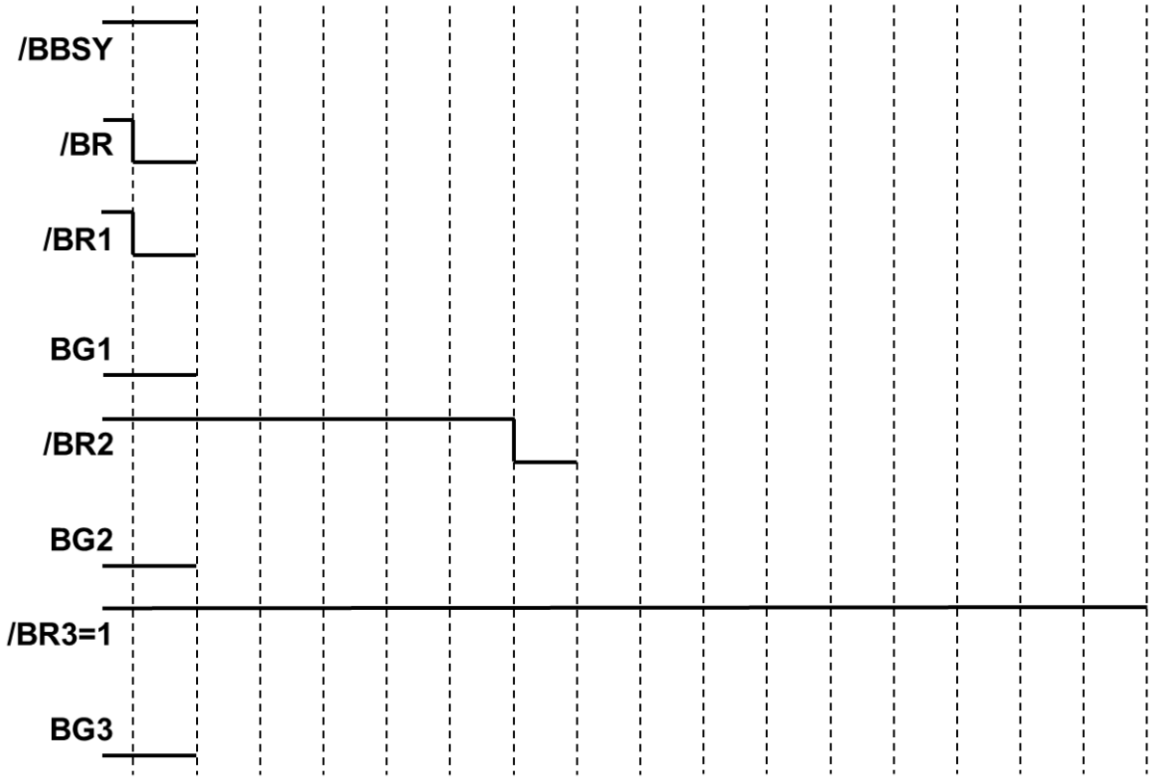
2. [5 points] Suppose some FSM has 3 input signals: *I/O device* **Ready**, *bus-free* **Free**, and *bus-grant* **Grant**, as well as 2 output signals: *bus-request* **Req** and *bus-lock* **Lock**. Show its Moore-type state diagram, assuming that the FSM implements the following bus protocol: (1) initially, the FSM outputs **Req = 0** and **Lock = 0** and waits for both **Ready** and **Free** to be asserted; (2) After receiving **Ready = 1** and **Free = 1**, the FSM outputs **Req = 1** and **Lock = 0** and waits for **Grant** to be asserted; (3) After receiving **Grant = 1**, provided that both **Ready** and **Free** still equal **1**, the FSM outputs **Req = 0** and **Lock = 1** and waits for **Ready** to become **0**; once **Ready = 0**, the FSM returns to step (1).
NOTE: Should **Ready** and/or **Free** become **0** while waiting for **Grant = 1**, the FSM returns to step (1). The FSM ignores the **Grant** input in steps (1) and (3), and it ignores the **Free** input in step (3).

3. [5 points] Recall the Mealy FSM state diagram on **Slide 38** of the **"Interfacing"** lecture notes, where the circuit is initially in state **Idle**. Given the input waveform shown below, draw the corresponding output waveforms.



4. [5 points] Consider the daisy-chain arbitration scheme shown below. Assume that the input-to-output signal propagation delays are the same and equal to **d** for all three devices, the inverter, and the **AND** gate. Also, assume that device **x** is able to start using the bus (making **/BRx = 1** and **/BBSY = 0**) only when it receives a **0-1** transition on its bus-grant input **BGx** and detects that the bus is not currently busy (i.e., **/BBSY = 1**). Also, assume that device **x** lets the bus-grant propagate through only when it is neither requesting nor using the bus. Finally, assume that any of the three devices will need to use the granted bus for only **3d** time units. Complete the timing diagram shown on the next page.


/BBSY
BG1
Device 1
BG2
Device 2
BG3
Device 3
/BR1
/BR2
/BR3
/BR


/BBSY
/BR
/BR1
BG1
/BR2
BG2
/BR3=1
BG3