MC48 Intra-term Exam 2b

Serial #:

This exam is an open-book, open-notes, individual-work exam. Please write your name only on this side of the page. If you need more space to work than the reverse side of this page, please staple your additional paper to this page. You have 30 minutes.

Name: ______________________________

Problem	Page	Possible	Score
1	1	12	
Total		12	

1. [**12 Points**] As in the original test, a new instruction, `beqir` is to be added to the MIPS instruction set. Recall that it is an I-format instruction, that is, it has the following general layout:

```
bits: 31-26   25-21   20-16    15-0
     +------+-------+-------+--------------------+
     |beqir | Rs    | Rt    |  immediate         |
     +------+-------+-------+--------------------+
```

   Recall that the meaning of this instruction is as follows. First the contents of the register specified by Rs is compared with the sign-extended immediate. If they are unequal, then nothing happens (execution falls through to the next instruction). However, if they are equal, then a branch occurs. The contents of the register specified by Rt tells how far (forwards or backwards) the branch should go; it is added to the address of the instruction following the `beqir` instruction in order to determine the address of the instruction that should be executed next. That is, if the address of the `beqir` is PC, and the value stored in the Rt register is x, then when the branch is taken, the next instruction fetched should be from address $PC + 4 + x$.

   This time, the instruction is to be added to the simple single-cycle implementation. The datapath, reproduced on the reverse, is not sufficient to execute this instruction without change (unlike with the multi-cycle implementation). Therefore, you are to make the changes needed to the datapath, so that it will be able to execute the instruction. In changing the datapath, you will also introduce one or more new control signal(s). Change the control truth table (also reproduced on the reverse) to have one or more new column(s) to correspond to the new control signal(s). Then fill in all of the new column(s) and all the new row that is for `beqir`.