EGC-442 HW #1 Dr. Izadi

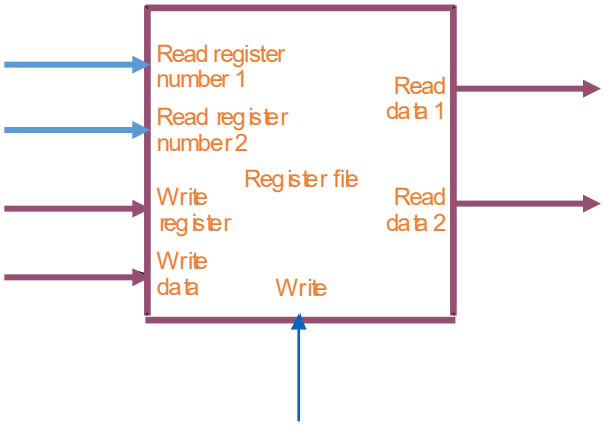
First Name: _____ Last Name: _____

Question 1 (20 Points)

a. Design a 4-bit register.

b. Utilize the block diagram of the 4-bit register from part a along with multiplexers, decoders, and any other needed gates to design a register file with 8 4-bit registers such that it can allow reading of any two registers and writing of any one.

c. On the block diagram similar to below, mark the number bits each line represent.



Question 2 (20 Points)

Do problem 1.7 in chapter 2

Question 3 (20 Points)

Do problem 1.8 in chapter 2

Question 4 (20 Points)

Consider two machines A and B. Machine A does not have floating point hardware and implements floating point instruction in software. It takes 20 and 40 Integer instructions to implement a floating point add (FADD) instruction and a floating point Divide (FDIV) instruction, respectively, on machine A. Machine B, on the other hand, has floating point hardware to directly execute FADD and FDIV. An integer instruction executes in one clock cycle on both machines, and FADD and FDIV execute in 3 and 6 clock cycles, respectively, on machine B. Consider a program which has 100 million instructions and the following mix of instructions:

- 10% FDIV
- 30% FADD
- 60% Integer instructions

a How many clock cycles will it take to execute the program on each of machines A and B?

b How long will it take to execute the program on each of machines A and B, assuming 1 GHz (1000 MHz) clock rate.

c How many native instructions will each machine execute? A native instruction is one that executes directly on the hardware. Note that machine A does not execute FDIV and FADD directly on the hardware, but rather executes 20 native instructions for each FADD and 40 native instructions for each FDIV.

d Compute MIPS rating (the number of million native instructions executing per second) for each machine.

Due Date: 2/17/2023