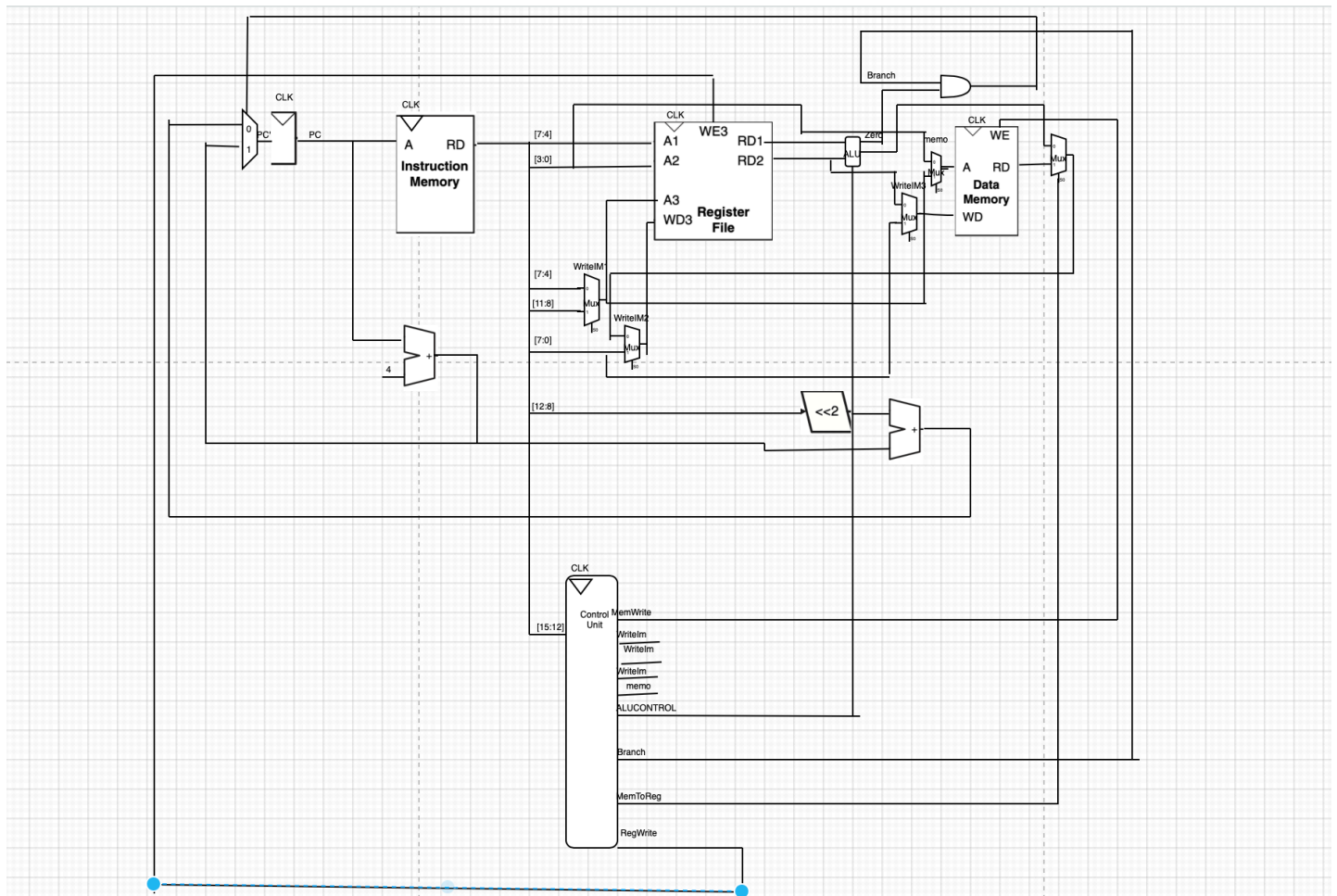# CS223 DIGITAL DESIGN SECTION 02 FINAL PROJECT ALPEREN ALKAN 21803216 24.12.2020

1) Block diagram of your controller/datapath and explanation.

By looking the chapter 7 in the digital design book I drawed my diagram. Basically, this diagram consist of 5 main element which are Instruction, memory register file, data memory, controller and ALU. Firstly, used PC (Program counter) to increase address of my IM. Then Register File takes instructions from the IM and it decode the instructions. Then I used data memory to record my values. The main purpose of the controller is to determine the inputs of mux and signals that data memory, register file and ALU takes. WI1 mux choose input Inst[7:4] and Inst[3:0] to determine the input for the Adress for the data memory and register file. WI2 is used to write data to register directly from Inst[7:0] or mux that is determined by memToReg. Also I used 2 more mux to determine the address of data memory and data that to be written to data memory. Also I used ALU to have a addition and comparison to determine if two register is equal. Also I used Branch output in my controller to jump desired instruction if two register is equal. By using muxes that I wrote, this diagram can take register value either from data memory or Inst[7:0]. Also it can take data to data memory either from register or Inst[7:0]. And this diagram can compare and add the values in the register file from the read register.

2) Detailed state diagram of the controller and explanation.

After drawing the data path diagram, I created state diagram of my control diagram. But after trying to code my controller, I had some difficulties to code my muxes so I changed my controller a bit. State diagram of my controller:
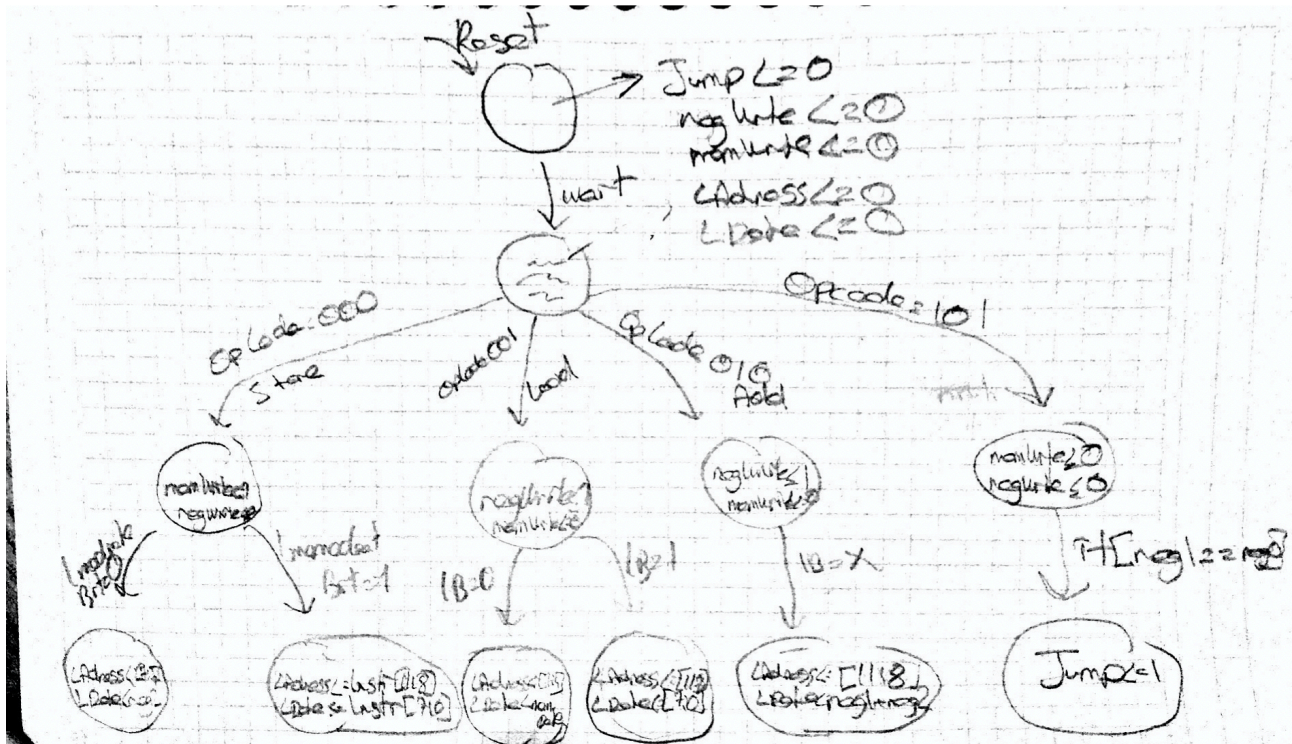
This state diagram basically look at the input opcode and if it is 000 it means that it is going to store element in the data memory. After 000, if Immediate bit is 0 data will be come from the register, however if it is 1 it comes directly from the IM. If Opcode is 001 it means that register will load a data, if IB(Immediate Bit) = 0 the data to register will be come from the data memory if it is 1 it will come from directly IM. If Opcode 010 it means two register data will be added to each other. If Opcode 101, it will be check if reg1==reg0 then if they are equal, IM will jump to the Instruction given.