

BLG222E - Computer Organization

Project 2

Implement the computer whose architecture is shown in figure 1. This is the **NOT** the same computer that is shown in class.

Use the ALU that you implemented in project 1. ALU should take one input from ALUBUS and other input from AC register. The ALU should have the same functions from project 1 and the flags of CCR should also be updated as mentioned in project 1.

There are 11 registers in the computer: PC, AR, SP, X, GPRA, GPRB, AC, IR, CCR, INPR, and OUTR. Each register should have control signals of load (LD), clear (CLR) and increment (INC). The register lengths are listed below.

Register	length
GPRA, GPRB, AC, IR	16-bit
AR, PC, SP	10-bit
INPR, OUTR, CCR	8-bit
X	5-bit

The value in X register is a signed value, and it should be extended to 10-bits before the addition. The multiplexer in the input of the AR works as follows:

S	MUX Output
0	IR(9-0)
1	X+DBUS(9-0)

When the 16-bit value in DBUS is loaded by PC, SP, or OUTR only the lower bits are transferred.

The control signals for ABUS are A_1 and A_0 . The registers write to the ABUS according to the following table:

Control signal		Register to write ABUS
A_1	A_0	
0	0	PC
0	1	AR
1	dont care	SP

The control signals for DBUS are D_2 , D_1 and D_0 . The registers write to the DBUS according to the following table:

Control signal			Register to write DBUS
D_2	D_1	D_0	
0	0	0	Memory
0	0	1	ABUS
0	1	0	GPRB
0	1	1	AC
1	0	0	GPRA
1	0	1	X
1	1	0	INPR
1	1	1	IR

The control signal for ALUBUS is M , and the registers write to the ALUBUS according to the following table:

Control signal M	Register to write ALUBUS
0	GPRA
1	GPRB

For the memory, you can use the memory unit supplied by logisim. The memory should have 10-bit address and 16-bit data words. It has 2 control signals read (R) and write (W).

Make sure to connect pins (under Wiring group of logisim) to all inputs and control inputs of your computer, so that different inputs and functions can be tested. Similarly connect a “Hex Digit Display” to the common bus and to the output of AC register so that the test outputs can be observed. Use proper labeling to improve the clarity of your circuits.

You do not have to implement a control unit for this project. All control signals will be given manually as inputs to your circuit.

Groupwork:

Group work is expected for this project. Make sure to distribute the work fairly amongst the group members. You might be asked to make a **10-minute** demonstration of your design with a few test cases.

What to turn in:

Implement your design for the register and simple computer in **logisim** software, upload a single compressed (zip or rar) file to ninova before the deadline. Only one student from each group should submit the project file. This compressed file should contain:

- the student number&names of the students in the group
- design (.circ) file for the computer
- a short report that lists of control inputs and corresponding functions of the simple computer

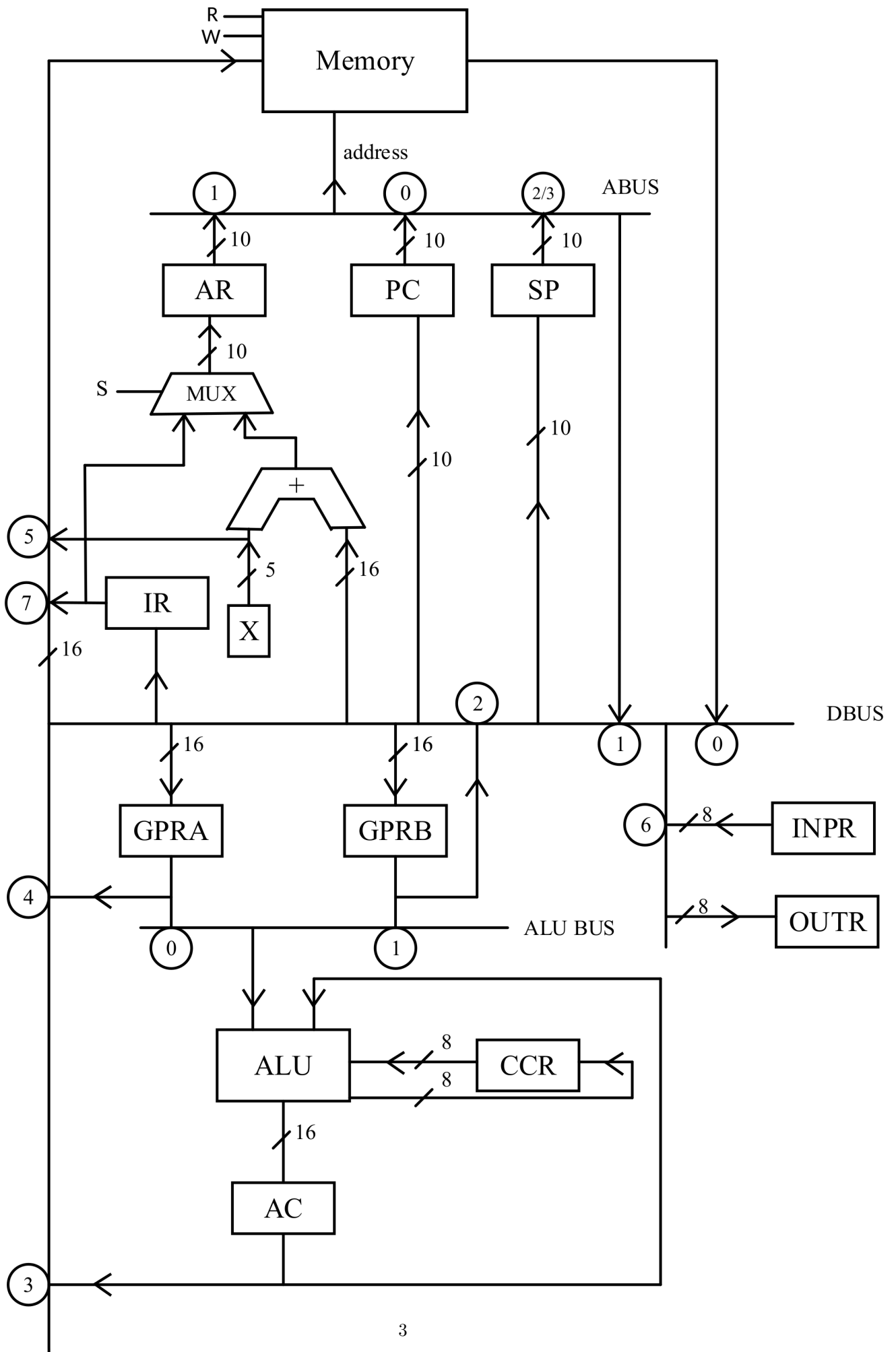


Figure 1: Computer architecture.