CS 125 - Lecture 3

Objectives:

- **Computers are not magic**
- **CPUs and the fetch-execute cycle**

2.

Q1: What number is represented by the bit pattern 010001?

Q2: What number is represented by the bit pattern 100011?

Q3: What number is represented by the bit pattern 011111?

3. Using 8 bits, **write these decimal numbers in binary representation**:

3_{10} =

10_{10} =

67_{10} =

7_{10} =

14_{10} =

254_{10} =

1. Computer Science Terminology – did your neighbor do the readings?

Discuss with your neighbor what a Computer Scientists means by the following terms and give an example of each:

- fetch-execute cycle
- CPU
- opcode
- operand
- register
- condition code

4. Arithmetic can be done with binary numbers:

https://www.youtube.com/tv#/watch?v=GcDshWmhF4A

$$\begin{array}{r} 11110_2 \\ +\ 00111_2 \\ \hline \\ \end{array}$$

2

5. Computing a Quiz Average: Pseudo-code to calculate a quiz average

1. get number of quizzes
2. sum := 0
3. count := 0
4. while count < number of quizzes
   - get quiz grade
   - sum = sum + quiz grade
   - count = count + 1
5. average = sum / number of quizzes
6. display average

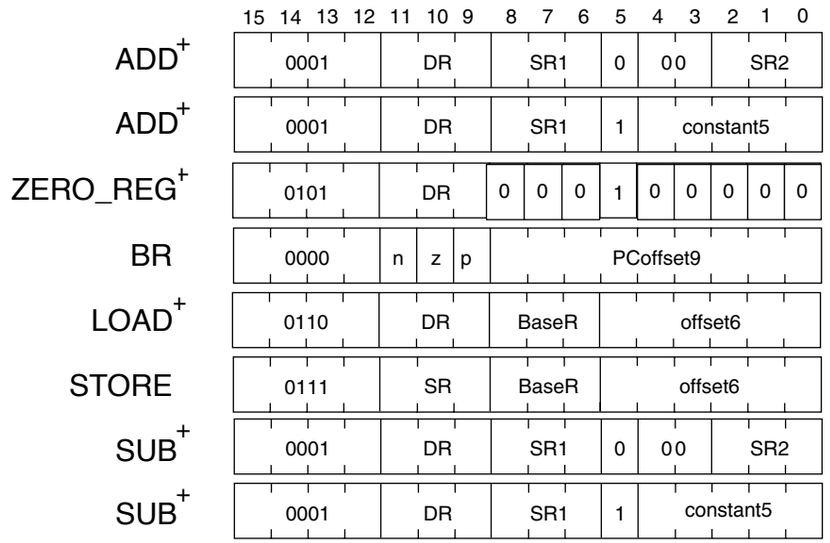
6. Write pseudo-code to print the highest quiz score:

A simple machine language:

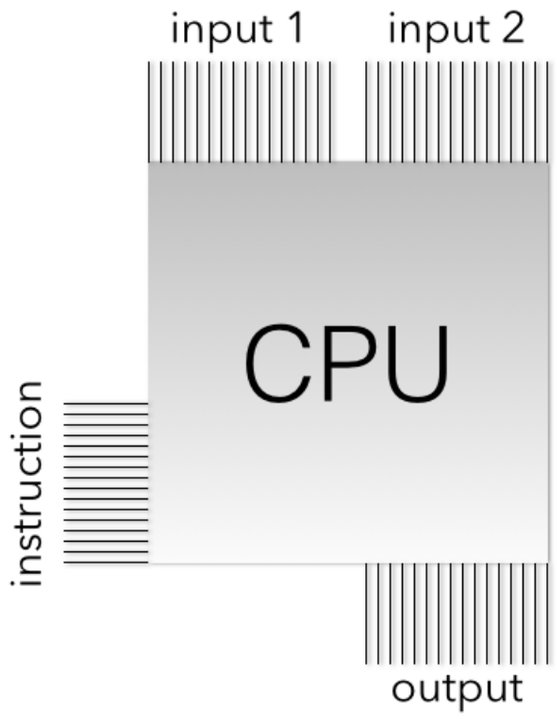
ZERO_REG DESTR – puts a zero in the specified register.
ADD SRCR1 + SRCR2 -> DESTR – add two registers together and write the result in the destination register.
ADD SRCR1 + CONSTANT -> DESTR – add a register to a constant and write the result in the destination register.
SUB SRCR1 - SRCR2 -> DESTR – subtract one register from another and write the result in the destination register.
SUB SRCR1 - CONSTANT -> DESTR – subtract a constant from a register and write the result in the destination register.
LOAD DESTR <- [BASER + CONSTANT] – add the value of a register to a constant to compute a memory address and copy 4 bytes starting at that address to the destination register.
STORE SRCR1 -> [BASER + CONSTANT] – add the value of a register to a constant to compute a memory address and copy the source register to 4 bytes of memory starting at that address.
BR.___ PCOFFSET – the branch instruction specifies a combination of condition codes (n, z, p); if any of the specified condition codes holds a 1, the PC is set to PC + 2 + 2(*PCOFFSET)*. Otherwise PC is set to PC + 2.

For all instructions other than the branch, PC is set to PC + 2. Any instruction that writes a general-purpose register also set the condition code bits: if new value is negative then n=1, else n=0; if new value is zero then z=1, else z=0; if new value is positive then p=1, else p=0.

7. Decoding an instruction:



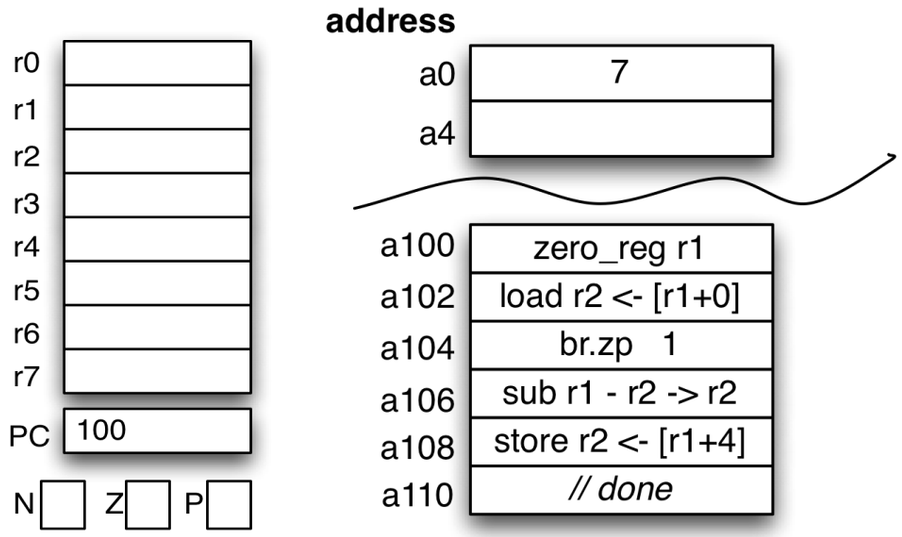
8. Schematic of a CPU:



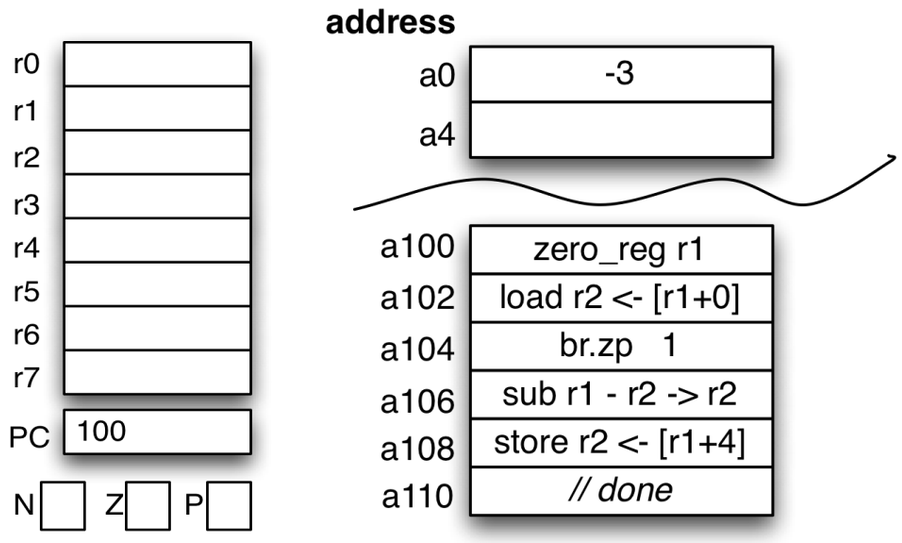
9. Decoding 16 bit-string instructions:

```
0111011001000100

0001100011000010

0101101000100000

0000110000001100
```

11. Execute a machine code program - me:

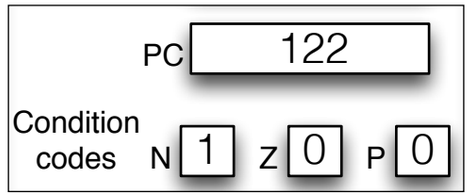


12. Execute a machine code program - you:



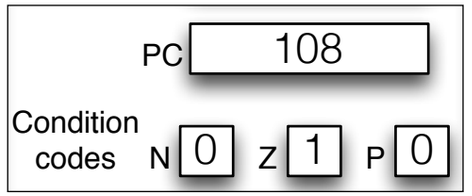
13. What does this code do?

10. All about that branch, 'bout that branch, 'bout that branch …



BR.N 6 PC =

BR.NZ -6 PC =

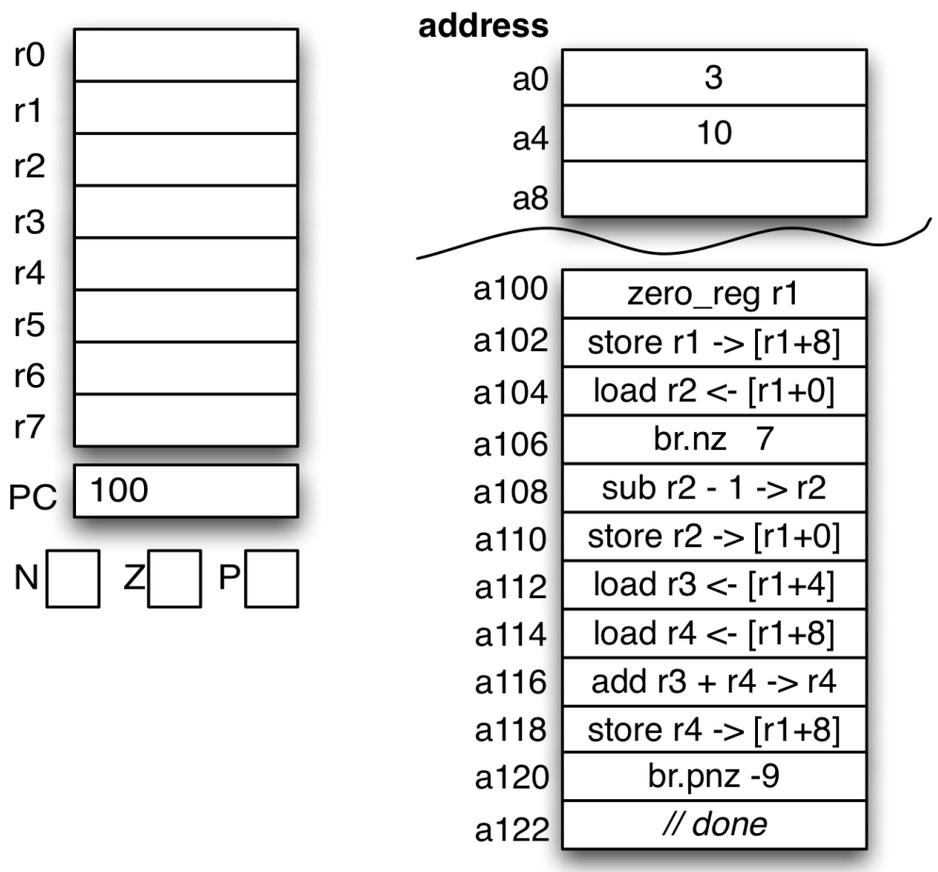


BR.NZP 22 PC =

BR.ZP -10 PC =

Workspace:

14. Execute a machine code program - you:



15. What does this code do?

Workspace: