CS210 Fall 2023: PS2A

Instructions

For all multiple choice questions, fill **ONE AND ONLY ONE circle**. Be sure to fill the circle in completely.
For all the questions, we encourage you to login into the provided UNIX environment and explore your answers. For some questions, you must use the UNIX environment to answer them.

If you use checkmarks or other symbols, the auto-grader may not be able to process your answer and will assign you a grade of zero.

All pages must have your name and id written on it. Unidentified pages will not be graded.

There is a total of 11 questions, for a total of 19 points.

First Name: _____ Last Name: _____

BU ID: _____

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PART A

1. (1 point) In a pipelined CPU, what is the purpose of the pipeline stages ?
   - ◯ To execute multiple instructions simultaneously.
   - ◯ To fetch and decode instructions in parallel.
   - ◯ To increase the clock speed of the CPU.
   - ◯ To store temporary data during execution.
   - ◯ All of the above.
   - ◯ None of the above.

2. (1 point) How do "jump" (*jmp*) instructions contribute to program control flow ?
   - ◯ They force the CPU to execute the same sequence of instructions repeatedly.
   - ◯ They allow for conditional execution of code.
   - ◯ They enable the CPU to transfer control to a different address in memory.
   - ◯ All of the above.
   - ◯ None of the above.

3. (1 point) Select the correct answer:
   - ◯ The PC register and IR register are general-purpose registers.
   - ◯ The PC register is used to hold the instruction of the opcode to be executed.
   - ◯ The PC register stores the memory address of the operation to be executed.
   - ◯ All of the above.
   - ◯ None of the above.

4. (1 point) How do registers differ from Main Memory in a computer system ?
   - ◯ Registers are smaller and faster but used for short-term storage, while Main Memory is larger and slower but used for long-term storage.
   - ◯ Registers are used only for storing data.
   - ◯ Main Memory is directly connected to the CPU, while registers are not.
   - ◯ All of the above.
   - ◯ None of the above.

5. (1 point) In the fetch stage of CPU execution:
   - ◯ The CPU retrieves the data directly from main memory.
   - ◯ The CPU retrieves the value from memory pointed to by the stack pointer register.
   - ◯ The CPU retrieves the address for the next instruction to be executed.
   - ◯ All of the above.
   - ◯ None of the above.

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6. (1 point) Which of the following best describes the ordering of internal phases of generic CPU program execution ?

   I: Retrieve the value at the location pointed to by the PC register.

   II: CPU conducts memory bus transactions to write results of a calculation to Main Memory.

   III: Identify the operation and the location of input and output values.

   - ◯ I, II, III.
   - ◯ II, I, III.
   - ◯ III, I, II.
   - ◯ I, III, II.
   - ◯ II, III, I.
   - ◯ III, II, I.
   - ◯ None of the above.

7. (1 point) An instruction:
   - ◯ Is encoded as a sequence of bytes in memory.
   - ◯ Is encoded in a CPU-specific way.
   - ◯ Has associated with it a human-readable mnemonic.
   - ◯ Directs the CPU to conduct a specific operation.
   - ◯ All of the above.
   - ◯ None of the above.

8. (1 point) Why is memory a critical component of a computer ?
   - ◯ It provides a large array in which data can be stored.
   - ◯ It is used to store the opcodes that form a program.
   - ◯ The CPU has a direct connection to memory.
   - ◯ All of the above.
   - ◯ None of the above.

9. (1 point) The operating system hides the complexity of I/O devices from “ordinary” programs.
   - ◯ True.
   - ◯ False.

10. (1 point) Addressing Modes are a way for specifying where the operands for an instruction come from.
    - ◯ True.
    - ◯ False.

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PART B

11. **Using gdb on Python**

The following questions require you to use your online server.

The executable file for python in your online server is:
`/opt/conda/bin/python3`

Using gdb, fill in the following answers. The command to start gdb with the python binary is:
`gdb /opt/conda/bin/python3`

(a) (1 point) Using the following gdb command "p /x &_start", determine the address of the symbol "_start" in hex.

_____

(b) (2 points) Using the examine gdb command "x/2xb &_start", what are the two byte values at the address of "_start" in hex ?

_____
_____

(c) (3 points) Set the disassembly syntax to intel with this gdb command "set disassembly-flavor intel". Then, use the "/1i" format with the "x" gdb command to disassemble the instruction that corresponds to these bytes.
The mnemonic is: _____
The first operand is: _____
The second operand is: _____

(d) (3 points) Convert the following values. Use gdb to check your answers using the print gdb command.
'0xda' in binary is: _____
'0b11010011' in hex is: _____
'0b01011110' in hex is: _____