**CIS 21JA Assignment 2 Name: Mega Putra**

*Questions 1 - 7 are 1 pt each*

1. Name the 4 parts of a CPU, and next to each part name, write one sentence *in your own words* to describe its main purpose. (I'm familiar with the descriptions in the class notes, so a copy-paste won't get credit)

* Arithmetic logic unit (ALU): where arithmetic and calculations take place, takes an input, and produces an output.
* Clock: used to pace sequential operations, which synchronizes data, also to trigger events.
* Control Unit (CU): directs sets of instructions to the entire computer system
* Registers: an accessible location intended for quick storage during operations.

2. With a 6-stage *pipelined* processor, where each stage takes 2 clock cycles, how many clock cycles does it take to execute 10 instructions? 6 + (10-1) = 15 x 2 cycles = 30 cycles   
  
With a 6-stage *non-pipelined* processor, with each stage also taking 2 clock cycles, how many clock cycles does it take to execute the same 10 instructions?  
(6x2) x 10 = 120 cycles  
3. With respect to the instruction execution cycle, what is the advantage of storing data in registers instead of in memory variables?

Since Registers allow temporary, quick, and accessible storage during CPU operations, during the instruction execution cycle, there are two possible steps that can be skipped by storing data in registers instead of in memory variables. Running fewer steps means faster execution time, which is generally more desirable. The steps that may be skipped are:  
During the **Operand Fetch** step, if the operand already exist in a register, there is no need to get that again. Other step is during the **Store Output**, when the CU writes data to memory, if output is already stored in a register then this step can be skipped as well.   
  
4. Our assembly programs uses 32 bits to address memory and can access up to 4 GB of memory. If you write assembly code for a system that uses 16 bits to address memory, what size memory can your program access?

2^16 bytes

5. If you convert an assembly program that is written for a RISC processor into a program that runs on a CISC processor, would the new program be longer or shorter? Why?

It will be shorter since CISC contains multiple set instructions for example a LOOP will just be one instruction. However, in RISC, for example, a LOOP will be divided into 3 instructions such as decrement, compare, and looping back. It is also because the high-level complex instructions are able to do multiple tasks, so the programs tend to be shorter.

6. How can a program that accesses up to 4GB of memory run on a system that only has 1GB of physical memory?

This can be done through paging, which is a coordination of different memory segments. Through the coordination of total memory used in the memory and on the disk, the total memory used can be larger than the physical memory. With the help of Virtual Memory Manager, the pages in the memory segment are managed.

7. Since conventional memory is slower than the CPU, what does the computer have to help make memory access faster? Your answer should not include registers, they don't help memory access speed.

The computer has cache memory.

8. (8pts) Download the file Assignment2.asm and bring it into the IDE Project. Then follow the steps in the file and fill in the data values you observe in the source file (the asm file). Then copy the data here to turn in your results.

mov ah, 100b ; AX = 0406

add ah, 2 ; AH = 06

inc al ; AL = 07

xor eax, eax ; EAX = 0000 0000

bigData in memory = 89 67 45 23 01 ef cd ab