# Comp 3350: Computer Organization & Assembly Language

# HW # 2: Theme: x86 Organization Basics

*All main questions carry equal weight.*

*(Credit awarded to only those answers with work shown)*

1. Name all eight 32-bit general-purpose registers. What is the general function of each of the registers? Which of these registers can be addressed in parts?
   1. Registers
      1. EAX – Accumulator (multiplication and division)
      2. EBX – Base register
      3. ECX – loop counter
      4. EDX – Data Register
      5. EBP – extended frame pointer(stack)
      6. ESP – stack pointer
      7. ESI – Index registers
      8. EDI – Index registers
   2. EAX EBX ECX EDX
2. What do the Sign Flag, Zero Flag, Auxiliary Carry Flag, and Parity Flag indicate when set?
   1. Sign – Tells whether the result is negative.
   2. Zero – The result is zero.
   3. Auxiliary Carry – Carry from bit 3 to bit 4.
   4. Parity – Tells is the number is even
3. What do the Overflow Flag and Carry Flag indicate when set? How do they differ?
   1. Both indicate that the sum is out of range.
   2. Carry is used for unsigned while Overflow is used for signed.
4. Detail the process by which instructions and data are read from memory.
   1. The desired address is placed on the address bus.
   2. The read line is set low.
   3. The CPU then waits one cycle for the memory to respond.
   4. Finally, the read line is set to high as the data is now on the data bus.
5. What do you understand by Cache memory and what are its benefits?
   1. There on two levels of cache memory. Level 1 that is stored inside the CPU and level 2 which is a little bite slower that is attached to the CPU. The benefits of cache memory is that it doesn’t have to be refreshed to keep it contents since it uses static ram.
6. What do you understand by Real-address mode, Protected mode, Multi-segment model? *Discuss in detail.* 
   1. Real-address mode – Only allows 1MB of memory to be used as well as only one program can be run on the processor. However, these programs can be halted temporarily to handle requests from peripherals. Programs can access any area of memory.
   2. Protected mode – Allows 4GB of memory to be used and allows for multiple programs to be run at the same time. Each program has its own protected partition from other programs.
   3. Multi-segment model – each program has a local descriptor table that holds a descriptor that for each segment that is used by the program.
7. In a 32-bit computer what are the maximum memory amounts that can be addressed in (a) real-addressed mode (b) protected mode? What is the linear address corresponding to the following segment-offset: 04B2:2033?
   1. 1MB
   2. 4GB
   3. **06B53**
      1. 04B20
      2. 02033
      3. 06B53
8. Let us say your computer is running at 3 GHz. You come to know that the Add instruction takes 6 clock periods in your computer. Express the time taken by the Add instruction in nanoseconds.

1/3GHz = .33ns.

.33ns \* 6 cycles = 2ns

Therefore it takes 2ns to run the add instruction.