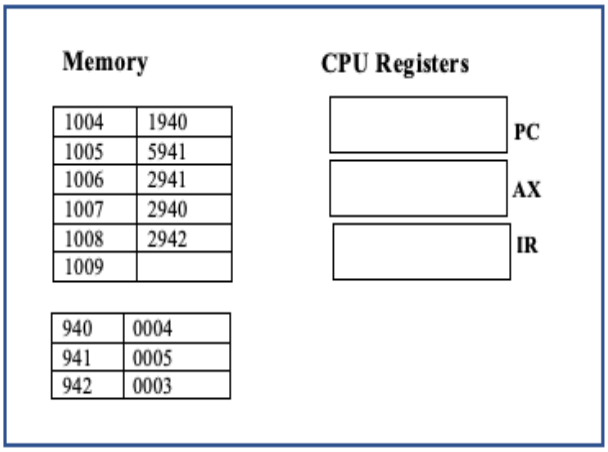
Sheet 1

1. If the instruction that will be executed is an add operation and Ax contains 0009H with the following format:

   a. What would be the contents of the registers PC and IR during this operation?
   b. What would be the contents of Ax after completion of this operation?



opcodes:
0001: load from memory
0010: Store AC to memory
0101: Add to AC from memory

2. Consider a hypothetical 32-bit microprocessor having 32-bit instructions composed of two fields. The first byte contains the opcode and the remainder an immediate operand or an operand address.
   a. What is the maximum directly addressable memory capacity in bytes?
   b. Discuss the impact on the system speed if the microprocessor bus has
      - A 32-bit local address bus and 16-bit local data bus.
      - A 16-bit local address bus and 16-bit local data bus.
   c. How many bits are needed for the program counter and the instruction register?

3. When an arithmetic instruction is executed the execution time is 4 clock cycles if the operands can be fetched from the cache (cache hit) meanwhile, 14 clock cycles if the operands have to be fetched from main memory (cache miss). The cache hit ratio is 0.6. How many clock cycles are needed on average to execute the instruction?

4. Consider a hypothetical microprocessor generating a 16-bit address where the address counter and the address register are 16 bits wide and having a 16-bit data bus.
   a. What is the maximum memory address space that the processor can access directly if it is connected to a 16-bit memory?
   b. What is the maximum memory address space that the processor can access directly if it is connected to an 8-bit memory?
5. List five services provided by an operating system that is designed to make it more convenient for users to use the computer system.
6. What is the purpose of interrupts? What are the differences between a trap and an interrupt?
7. Distinguish between batch systems and time-sharing systems.
8. What is the real-time system? Determine the different types of it.
9. Define the process and describe the control process block.
10. What is the main advantage of multiprogramming and the disadvantages of multi-processor systems?