1. EAX - automatically used by multiplication and division instructions. EAX can be addressed.
ECX - used as a loop counter
ESP - addresses data on the stack
ESI and EDI - high-speed memory transfer instructions
EBP - used by high level languages to reference function parameters and local variables on the stack
EBX - used in indexed addressing
EDX - used in input/output operation

The registers that can be used in parts are EAX, EBX, ECX, and EDX.

2. Sign flag - indicates arithmetic or logical operation results in a negative result
zero flag - indicates arithmetic or logical expression results in 0
Auxiliary carry flag - set when an operation caused a carry from a 3 bit to 4 bit in an 8 bit operand
parity flag - indicates least significant byte in the result contains an even number of 1 bits. In general, is used for error checking when there is a possibility that data might be corrupted

overflow flag - set when result of signed arithmetic is too large or too small to fit its destination

Carry flag - set when unsigned arithmetic operation is too large to fit into the destination

Carry flag deals w/ unsigned arithmetic, while overflow flag deals w/ signed arithmetic

3. Step 1: place the address of the value you want to read on the address bus
Step 2: Assert the processor's RD pin
Step 3: Wait one clock cycle for the memory chips to respond
Step 4: copy the data from the data bus into the destination operand

4. Cache memory is used to reduce the amount of time spent reading and writing memory. Cache stores the most recently used in high speed memory for quick access. The advantage to cache memory is that it is faster than conventional RAM.

5. real address mode - Implements the programming environment of early Intel processor w/ a few extra features. It has the ability to switch into other modes. This mode is useful if a program requires direct access to System memory and hardware devices.

protected mode - native state of the processor in which all instructions and features are available. In this mode, programs are given separate memory areas named segments. The processor prevents programs from referencing memory outside their assigned segments

Multi segment model: up to six active segments
- can have more than 6 segments
- segment registers hold pointers to segment descriptor tables. Some segments hold program instructions, others hold variables, stack segments hold local function variables and function parameters

6. a.) $2^{16} =$ 65,536 bytes

b.) $2^{32} = 2^{16} \cdot 2^{16} \cdot 2^{16} \cdot 2^{16} \approx 4$ GB

7. $2.5\ GHz = 2.5 \times 10^9 \frac{\text{clock cycles}}{\text{sec}}$

$$5 \text{ clock cycles} \left| \frac{\text{sec}}{2.5 \times 10^9 \text{ clock cycles}} \right| \left| \frac{10^9 \text{ nanoseconds}}{1 \text{ sec}} \right|$$

$= 2.0$ ns