Question 1: Explain the function of each of the following:

i. Assembler
   The Assembler is a program that translates from assembly language to machine language.

ii. Instruction Pointer (IP).
   The Instruction Pointer is a register that holds the address of the next instruction to be fetched from memory.

iii. Instruction Register (IR).
   The Instruction Register is a register that is used to store temporarily the fetched instruction for execution.

Question 2: Name all registers of the 8086 processor. Arrange the registers in groups.

   AX      BP      SI      DS      FLAG REGISTER
   BX      SP      DI      CS
   CX      ES      SS      IP

Question 3: Determine the machine type and the size of the address and the data buses for the 8086 processor.

- 16 bit processor
- 16 bit data register and 20 bit address bus

Question 4: Determine whether the following operations are performed in the fetch or execute phase:

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading an instruction from Memory</td>
<td>Fetch</td>
</tr>
<tr>
<td>Reading Operands from Memory</td>
<td>Execute</td>
</tr>
<tr>
<td>Decoding an Instruction</td>
<td>Execute</td>
</tr>
<tr>
<td>Incrementing the Instruction Pointer.</td>
<td>Fetch</td>
</tr>
</tbody>
</table>

Question 5: Order the following storage devices in terms of speed from fastest to slowest: Cache, RAM, Tape, Registers.

Registers, Cache, RAM, Tape
**Question 6:** Given two numbers \( A = 7FH \) and \( B = 3 \), assuming that they are represented as 8-bit 2’s complement numbers. Perform the following arithmetic operation and indicate whether an overflow occurs: \( A + B \)

\[
\begin{array}{c}
0111 1111 \\
+ \hspace{1cm} 11 \\
\hline
1000 0010 \\
\end{array}
\]

\( \Rightarrow \) Result will be interpreted as a negative number hence overflow

**Question 7:** Given the binary number 11100010 represented in an 8-bit format. Determine all possible values that this number can represent.

\( 11100010 \Rightarrow E2h \)

\( 226_{10} \)

- \( 30_{10} \) (MSB = 1 expressed in 2’s complement)
- \( 62h \) (MSB = 1 expressed in signed magnitude)

‘*’ ASCII Character

**Question 8:** Given the following declaration in the data segment:

``` assembler
.data
A DB 34H
B DW ?
M EQU 234H
C DW 'AB'
```

Show how these values would be represented in memory, if we suppose that data is put in memory starting from address: 2000 H

<table>
<thead>
<tr>
<th>Address</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1FFF</td>
<td>..</td>
</tr>
<tr>
<td>2000</td>
<td>34</td>
</tr>
<tr>
<td>2001</td>
<td>?</td>
</tr>
<tr>
<td>2002</td>
<td>?</td>
</tr>
<tr>
<td>2003</td>
<td>41</td>
</tr>
<tr>
<td>2004</td>
<td>42</td>
</tr>
<tr>
<td>2005</td>
<td>..</td>
</tr>
</tbody>
</table>