Question 1

a) State 3 differences between 8088 and 8086 microprocessors.

b) State 3 differences between microprocessors and microcontrollers

c) State 4 different types of addressing modes. Give example for each showing how the physical address is calculated from the effective address.

d) Identify the type and the capacity of each of the following memory chips:
   i) 6116   ii) 27512   iii) 2564   iv) 28256

Question 2

a) In a typical minimum mode 8088 microprocessor system, show to what logic levels should the following signals be connected to. What is the function of each pin?

   i) HOLD     ii) ALE     iii) M/IO     iv) READY     v) INTA     vi) NMI     vii) TEST

b) Design an simple input port with address F3 and write an assembly language program that reads a byte from that port, increment it by 1, and saves the result in memory location 5000. (Use Nand gates and a decoders)

c) State 4 differences between memory mapped I/O and isolated I/O.

Question 3

a) Draw a fully buffered 8086 microprocessor system.

b) Design a memory system for the 8086 microprocessor. The RAM is designed using 6116 chips and should occupy the address range 00000 - 03FFF. The EPROM is designed using 2764 chips and should occupy the address range F0000 - FFFFF. Draw the complete design using decoders and gates.
Question 4

The shown figure illustrates interfacing 8255 to an A/D converter. Write an assembly language program to set up PORT A to read data, PROT B to display data, bit PC2 to start conversion and bit PC7 to read the ready status of the converter. PORT C is programmed in BSR mode. Assuming that the analog input is coming from a temperature sensor, write an assembly language program that reads the temperature in Fahrenheit degrees (F) from PORT A, convert it to Celsius degrees (C), and send it to the display.

\[ C = \left( \frac{F - 32}{9} \right) \times 5 \]

Question 5

a) State 4 differences between SRAM and DRAM. Illustrate how DRAM is connected to 8088 microprocessor system. Draw the hardware design.

b) Why would you want 8088 microprocessor to insert wait states? Draw a hardware circuit that can insert 3 WAIT states. describe how the circuit is functioning.

c) State 4 differences between debugger and microsoft macro assembler. Describe the complete steps to develop an assembly language program in sebugger and in macro assembler.
Question 6

The following assembly procedure calculates the integer square root of a 32 bit unsigned integer saved in the double word given by DX and AX registers. Assuming that the 32 bit number is decimal 10000, go through the instructions and show that the square root (100) will be returned in BX after finishing the procedure. The original number in DX:AX is not affected. Can you estimate the algorithm upon which the square root is calculated?

```
SQRT32    PUSH  BP
          PUSH  DX
          PUSH  AX
          MOV   BP, SP
          MOV   BX, 200
          DIV   BX
          ADD   AX, 2

NXT_APP : MOV   BX, AX
          MOV   AX, [BP]
          MOV   DX, [BP+2]
          DIV   BX
          ADD   AX, BX
          SHR   AX, 1
          CMP   AX, BX
          JE    DONE
          SUB   BX, AX
          CMP   BX, 1
          JE    DONE
          CMP   BX, -1
          JNE   NXT_APP

DONE :    MOV   BX, AX
          POP   AX
          POP   BX
          POP   BP
          RET
```

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