M.Sc. (Informatics) – I Semester – 2011

IT – 15 – Microprocessor and Interface Programming

Time : 3 Hrs. Max. Marks : 75

Note : Attempt five questions in all. Question No. 1 is compulsory

Q1.a) The original contents of AX, BL, word- size memory location SUM, and carry flag CF are 1234_{16}, AB_{16}, $00CD_{16}$, and 0_{16}, respectively. Describe the results of executing the following sequence of instructions.

```
ADD AX, [SUM]
ADC BL ,05H
INC WORD PTR [SUM]
```

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b) Describe what happens to the status flags as the sequence of instructions that follows is executed.

```
MOV AX, 1234H
MOV BX, 0ABCDH
CMP AX, BX
```

Assume that flags ZF, SF, CF, AF, OF, and PF are all initially reset. 2

c) Data are to be read in from two byte-wide input ports AA_{16} and $A9_{16}$ and then output as a word to a word-wide output port at address $B000_{16}$. Write a sequence of instructions to perform this input/ output operation. 2

d) What value should be written to ICW_1 in order to configure the 8259 so that ICW_4 is needed in the initialization sequence, the system is going to use multiple 8259s, and its inputs are to be level sensitive? Assume that its unused bits are to be logic 0. 2

e) Describe the operations performed by each of the following instructions.

(i) IDIV BYTE PTR [BX][SI] + 0030H

(II) NOT WORD PTR [BX+DI]

(III) OR BYTE PTR [BX][DI]-10H, 0F0H

(IV) SBB DL, [0200H] 2

f) A 16 KB block of memory, composed of two 8KB EPROMS, is to have a starting address of 4000H. What is the address range for each EPROM? 1

g) Explain the following signal description of 8251.

(i) TXD (ii) TXRDY 2

h) What is the mode and i/O configuration for ports A,B, and C of an 8255 after its control register is loaded with 82H? 2

Q2 a) (i) What instructions are needed to program counter 0 for BCD counting in mode 4 of 8254? The initial count is 4788. (Assume that control word location as CC83H and initial count to port C at CC80H.)

(ii) What control word is needed to program counter 2 for binary counting in mode 1, with an initial count of A0H?

(iii) What instructions are needed to latch the count in counter 1 and save it in register BX?

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Q2 b) Design an interface of an input port 74LS245 to read the status of switches SW_1 to SW_8, and an output port 74LS373 with 8086. Display the number of a key that is pressed, i.e., from 1 to 8 on a seven segment display with help of a output port. The input port address is 0008H and output port address is 000AH. 6

Q3 a) Describe the architecture and explain the working of programmable interrupt controller 8259A. 10

Q3 b) Interface DAC AD 7523 with an 8086 CPU running at 8MHz and write an assembly language program to generate a sawtooth waveform of period 1ms with V_{max} = 5V. 5

Q4 a) Explain briefly the interfacing of static and dynamic RAM 5

Q4 b) Write an instruction sequence that generates a byte size integer in the memory location defined as RESULT. The value of the integer is to be calculated from the logic equation

$$(RESULT) = (AL)*(NUM1) + (\overline{NUM2})'* (AL) + BL$$

Assume that all parameters are byte-sized. NUM1, NUM2 and RESULT are the offset addresses of memory locations in the current data segment. 5

Q4 c) Implement the following operation using shift and arithmetic instructions.

$$7(AX) - 5(BX) - (BX)/8 \rightarrow (AX)$$

Assume that all parameters are word sized. State any assumptions made in the calculations. 5

Q5 a) Given an array A(I) of 100 16 bit signed integer numbers, write a program to generate a new array B(I) so that

$B(I) = A(I)$ for I = 1 and 100

and $B(I) = \frac{1}{4}[A(I-1) - 5A(I) + 9A(I+1)]$ for all other I's

For the calculation of B(I), the values of A(I -1), A(I) and A(I+1) are to be passed to a subroutine in registers AX, BX, and CX and the subroutine returns the result B(I) in register AX. 6

Q5 b) Explain various interrupts of 8086µp. 4

Q5 c) Write a program sequence to move a string located at SRCADDR to the location DSTADDR for the condition (i) SRCADDR > DSTADDR and (ii) SRCADDR < DSTADDR. 5

Q6 a) Write a complete data segment DATA_SEG that would assign the integer 5 to a byte NUM and the integers -1,0,2,5, and 4 to the first five elements of the 10 word array DATA_LIST. Then write a complete code segment that would :

(i) Place the largest and smallest of the first five numbers of DATA_LIST in BX and DX respectively.

(ii) Calculate the sum and the product of the first five numbers in DATA_LIST and store the results in SUM and PRODUCT respectively. 6

Q6 b) Explain various addressing modes of 8086µp. 4

Q6 c) Explain various flags of PSW for 8086µp. 5