

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
BE (CST) PART III 5th SEMESTER FINAL EXAMINATIONS, 2012

Microprocessor based digital design (CS 503)

F.M: 70

Time: 3 hrs.

Answer any six questions taking a maximum of three from each group in a single answerscript.

Two marks are reserved for neatness in each Group

Group A

1. a) Draw the processor programming model of 8086 and also show the addressing modes used for all memory referenced instructions. For each addressing mode show at least two examples. You may define a suitable data segment along with appropriate variables to use them in your examples.
b) Show the standard stack based parameter passing scheme using assembly language program segments implemented by the compiler for function calls with parameters. Also show how the local variables are allocated space in the stack. Assume that the main program has two parameters (word-size) to be passed to the called function and the called function also needs 4 word-size local variables to be allocated in the stack. [5+6]
2. a) Show the decoding scheme using a 74LS156 dual 2-4 decoder with OCF output to generate chip-select signals for the following devices. You are supposed to show the qualifier signals; if any. Note that the device address is specified within the parentheses.
i) Output Port (2346H), ii) Input port (09A4FH), iii) Input port (80H) and iv) Output port (80H)
b) Show the decoding in detail and draw the memory map for a small system with the following components indicating clearly the assumptions that are being used to solve the problem. [4+7]
i) 1 x 8085A CPU; ii) 2 x 2732; iii) 2 x 6116; iv) and v) 2 x 8255 PIO.
3. a) Show the minimum hardware required to display the status of the 8085A flags through 5 LEDs (LED ON indicates a Flag is set). Assume that the user would call a subroutine through software interrupt (say, RST 5) which would be placed after an instruction in the assembly language routine to know the status of the flags at that point. Write the subroutine which would take the help of the hardware to display the flags.
b) Using appropriate examples show the use of the assembler directives *ORG*, *EQU*, *DB* and *DW*. [7+4]
4. a) Draw the processor programming model of the MCS-51 series microcontroller showing its program memory and data memory. The register banks and SFR space etc. are to be clearly shown. Also draw the data RAM area along with the address of the bits that can be manipulated by the Boolean processor.
b) Write three different sub-routines in assembly languages of 8085A, MCS-48 (Page 3) and MCS-51 (any page using DPTR) to implement conversion of a byte valued integer to another byte valued integer given by two sets; {0,1,2,3,4} and {43H, 12H, 0F2H, 9BH, 00H} respectively. So, 0 has to be converted to 43H, and so on. [4 + 7]
5. a) Draw the timing diagram of an MR machine cycle with two wait states of the 8085A processor.
b) Write a program in X-86 assembly to compute the square root of a perfect square number. The perfect square number is to be defined as one variable in the data segment. Use the algorithm which adds the first n odd natural numbers. The sum of the first n odd natural numbers is equal to $n \times n$. [3 + 8]

Group B

6. a) What is baud rate? Draw a diagram (roughly to the scale) to show the signal being transmitted over a serial line when you are transmitting the data bytes 5AH followed by 19H. Assume no parity bit is being transmitted and the stop bit is $1\frac{1}{2}$ bit wide. [6+5]
- b) Write a Console-in (C_{in}) routine which takes its input from the SID line of the 8085A processor running at 3.0 Mhz. Assume that the transmission speed is 1200 bits/second. You are supposed to write the delay routine and show the calculation (approximate) for the delay value. [5 + 6]
7. a) What is interrupt? Describe the mechanism used in 8085A to serve an interrupt request through the line INTR. In terms of MCS-48 CPU describe what happens when the following program is executed.

```
START: DIS TCNTI
CLR A
MOV T, A
MOV R7, A
STRT T
MAIN: JTF COUNT
```

```
JMP MAIN
COUNT: INC R7
MOV A, R7
JB3 INT
JMP MAIN
INT: STOP TCNT
JMP 7H
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- b) Describe the 8259 PIC (Programmable Interrupt Controller) in short. [7 + 4]
8. a) Enumerate the properties of a RISC processor. The advantages of each such property have to be clearly specified.
- b) Show with a neat diagram the concept of Register Window scheme for parameter passing in Berkeley RISC processor. How many registers would be needed if we consider a nesting level depth of 6 keeping the number of global, local and shared registers as 18, 12 and 8 respectively for each procedure? [5 + 6]
9. a) Write a subrouitne in 8085A aseembly language to multiply two bytes available in A and B registers. Return the result in AB where A and B contain the higher and lower order part of the result, respectively.
- b) Write a subrouitne in 8085A aseembly language to divide two bytes available in A (divisor) and B (dividend) register. Return the result in A (quotient) and B (remainder). [4+7]
10. a) Why ARM microcontrollors are used in many embedded control applications? Draw the programming model of the ARM 7 processor indicating different mode of operations.
- b Show how the code size can be reduced with the help of Conditional execution of instructions. [Hint. You may use an example implementing the GCD algorithm.] [5 + 6]