

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
BE 5th SEMESTER (CST) EXAMINATION, 2011
Microprocessor based Digital Design (CS 503)

F.M: 70

Time: 3 Hours

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

Two marks are reserved for neatness in each group.

Group A

1. a) Using an EPROM (specify the size and contents of the locations) as a decoder show the decoding in detail and draw the memory map for a small system with i) One 8085A CPU; ii) Two 2716 (2K×8) EPROM; iii) Two 6116 (2K×8) RAM and iv) One 8255 PIO.
b) What is foldback? How foldback can be avoided? Is it always necessary to avoid foldback? [7 + 4]
2. a) Draw the programming model of 8085A CPU. Name the addressing modes available and also write a subroutine which when called returns the status of the flags in Accumulator.
b) Write a sub-routine to divide two integers. Use B-register to pass the dividend and C-register to pass the divisor (which may not be equal to 0) to the sub-routine. The subroutine returns the quotient in B register and remainder in A-register. [7+4]
3. Write an assembly language (8085A) sub-routine to produce a variable amount of delay. The delay will be produced through 3 nested loops where the delay values have to be in B, C and D registers, respectively.
b) Write an assembly language program using the assembler directives *ORG*, *DB* and *DW*. The program would copy an 8 byte table (initialised with 8 byte data) into a 4 word (2-byte/word: initialised to 0). [7+4]
4. a) What is a microcontroller? In small system design why it is preferred over the standard microprocessor. Draw the processor programming model of the MCS-48 series micro-controller showing its program memory and data memory. The register banks and stack space are to be clearly shown.
b) Discuss the use of the following instructions i) *MOVP3 A, @A* and ii) *DJNZ Rx, label*; where Rx stands for one of the eight data registers. [7 + 4]
5. Write short notes on: (Any two) [5½ × 2]
 - i) Common Assembler directives with examples.
 - ii) Problems in implementing Single step operations without h/w support like Trace flag.
 - iii) Bus contention and its avoidance.

Group B

6. a) Use the control lines lines (\overline{RD} , \overline{WR} and IO/\overline{M}) to generate the memory and I/O read-write signals; namely, \overline{MEMRD} , \overline{MEMWR} , \overline{IORD} and \overline{IOWR} . Use appropriate decoder and clearly mark the I/O and enable lines of the decoder.
- b) Write a subroutine (in 8085A assembly language) to add two multi-byte words in memory. The result of the addition should replace the first operand word in memory. Also assume that the multi-byte words are stored in consecutive memory locations in little endian mode. The subroutine would take three parameters; two address pointers to the operands and one byte count reflecting the width of the operands in bytes. [4 + 7]
7. a) Write a subroutine to sign-extend an 8-bit number available in C-register to a 16 bit number to be returned through BC-register to the caller. MSB of B register holds the sign bit.
- b) An address (16 bit) is being formed by accepting successive key-press and storing the key-value (0H to 0FH) in a 4 byte left-in right-out buffer named ADDBUF. Write a subroutine to convert this 4-byte (MS nibble of each byte is zero) to a 16 bit address to be returned through HL-register to the caller. [5 + 6]
8. a) 'Relative addressing help produce relocatable code'— endorse this statement using appropriate assembly language program segment?
- b) What are stack and stack pointer? Name the instructions where stack operations are involved. Also write about three specific usage of the stack. How the stack is implemented in MCS-48 series Micro-controller? Is there any disadvantage with this limited stack space in MCS-48? [5 + 6]
9. a) Draw the processor programming model of 8086 and also show the addressing modes used for all memory referenced instructions.
- b) Write a procedure *putchar(c)* in X86 assembly language utilising function no. 2H of DOS INT 21H call which prints the character in the default output device (usually the console) while the ASCII code of the character to be printed should be passed to the DL register. [6+5]
10. Write short notes on: (Any two) [5½ × 2]
- Basic properties of a RISC processor and utilisation of large register file for implementing parameter passing through register window.
 - Programmable Interrupt Controller (8259): functional diagram and steps to handle interrupt request to serve a 8085A CPU.
 - Programming model of a typical ARM processor including the operations done in the barrel shifter.