INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN & MANUFACTURING, JABALPUR (M.P.)

Quiz #1

Sept.-2023

EC2002 – Digital Electronics and Microprocessor Interfacing

Max. Marks: 20 Time: 1 Hour

Instructions: 1. Consider spending time/elaborating answers according to respective marks weightage.

2. The marks for each question or its part are mentioned within the square bracket [ ] at the end of the question.

3. There will be step marking, so solve the problem by following all the steps and mentioning logic/theorem clearly. Direct answers will not be awarded any mark.

4. Assume any missing data suitably and clearly mention it.

Q.1 Convert the following numbers as indicated (No direct answer):

(a) 181_{10} to Binary [1]

(b) 10110.0101_2 to Decimal [1]

(c) 127_8 to Decimal. [1]

Q.2 Perform the following arithmetic operations as indicated:

(a) Binary Subtraction: 0101101101-10000110 using radix complement and cross check the result with direct binary subtraction. [2]

(b) BCD Addition: 01100100 + 00100111. Cross check the result with decimal figures. [2]

Q.3 (a) Simplify the following Boolean function F using Karnaugh map:

$F = x'yz + w'xz + wxy'z + xyz' + w'xy + wxy'z' + w'x'y' + yz'$. [3]

(b) What will be the simplified function, if the following don't care conditions are specified for the above function,

$D = wx'y'z' + wxyz$ [Don't care condition] [1]

Q.4 Draw the logic circuit using AND-OR-NOT gates for the following Boolean expression:

$Y = (A.B' + C).D' + E$. [2]

Q.5 Design a simplest (reduced) combinational circuit with three inputs a, b, c; and two outputs X and Y. The output X is high (equal to logic 1) when the equivalent decimal value of the input is less or equal to 3, otherwise, the output X is low (equal to logic 0). The output Y is high (equal to logic 1) when number of 1's in the input is odd, otherwise, it is low (equal to logic 0). [Follow and mention each design step clearly]. [5]

Q.6 Write the DeMorgan's Theorem for two variables and verify using truth tables. [2]

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN & MANUFACTURING, JABALPUR (M.P.)

Set-A

End Semester Exam
Nov.-2023

EC2002 – Digital Electronics and Microprocessor Interfacing

Max. Marks: 55 Time: 3 Hours

Instructions:
1. Consider spending time/elaborating answers according to respective marks weightage.
2. There will be step marking, so solve the problem by following all the steps and mentioning logic/theorem clearly. Direct answers will not be awarded any mark.
3. The marks for each question or its part are mentioned within the square bracket [ ] at the end of the question.
4. Assume any missing data suitably and clearly mention it. Consider don't care bits as zero.
5. Mention Set-A on top-right corner of your answer sheet.

Q.1 **Answer the following questions in brief: (Maximum 3-6 lines + figure, if needed)** [2 each]

(a) What is BCD number system? How is it different from hexadecimal system? How many minimum binary bits are required to represent numbers in the range of 0 to 9999.

(b) How many terms and literals are present in the following Boolean expression:

$Y = ab'd + ac + a'b'cd' + ab'cd' + b'c'd'$

(c) What do you mean by min terms in a Boolean expression. Give examples.

(d) Draw a positive-edge detection circuit along with a timing diagram illustrating its operation.

(e) Draw a schematic diagram of a master-slave J-K flip flop using SR flip flop. Why is it termed as a master-slave, explain using timing diagram?

(f) How many machine cycles are needed to execute *"MVI A, 25H"* in 8085 µP? Write their name/s in order of execution.

(g) What is the difference between RST5.5 and RST6?

(h) Is it necessary to initialize Stack Pointer, in case of 8085 µP, when subroutines are used in the main program? Why?

(i) What is a bidirectional Tri-state buffer?

(j) What is the maximum count value (hex) we can load in an 8155 timer? Explain in brief.

Q.2 Perform the binary Subtraction: 1101101-101000110 using radix complement. [2]

Q.3 For the Boolean expression $F = (a + c)(a' + b')(a + b + c')$,

(a) Find its complement $\bar{F}$, and create a truth table. [1.5]

(b) Represent it in the canonical form. [1.5]

(c) Draw logic circuit to implement it using basic logic gates. [1]

Q.4 Draw and explain schematic circuit of a 4-bit asynchronous (ripple) counter. [3]

Q.5 Explain the difference between Ring counter and Johnson counter. [3]

Q.6 Define register and illustrate the operation of a three-bits register with parallel loading. [4]

Q.7 For assembly language program of 8085 microprocessor provided in the box below, answer the following questions:

```
Start:  LXI H, 2000H
        MOV C, 10H
        MOV A, M
here:   INX H
        ADD M
        DCX C
        JNZ here
        STA 2500H
        HLT
```

(A) Identify two mistakes in the program and suggest possible corrections. [2]

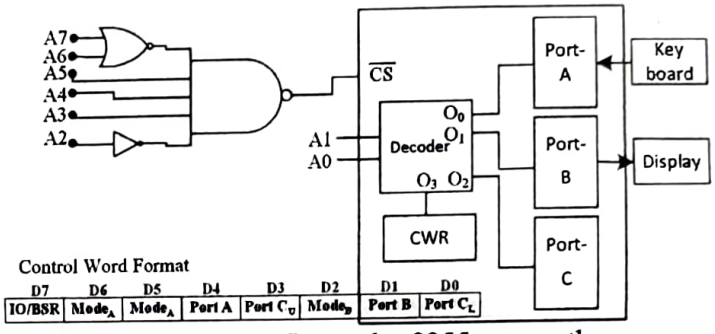
(B) Specify the size of the program in number of bytes. (After considering above corrections). [1]

(C) Make a flowchart for this program. [1]

(D) What will be the contents of C, H and L registers at the end of the program? [1.5]

(E) What this program is doing? (Write title/description of the program). [1.5]

Q.8 A keyboard and display has to be interfaced with 8085 microprocessor, as shown in the figure. Find out: (a) Addresses of different ports and registers as per the interfacing shown in the figure. (b) Write appropriate assembly language code with comments to suitably configure the 8255 as per the schematic for reliable data transfer (handshake mode), and send the data available at the keyboard to the display. [Consider don't care bits as zero.] [5]



Control Word Format

D7	D6	D5	D4	D3	D2	D1	D0
IO/BSR	Mode$_A$	Mode$_A$	Port A	Port C$_U$	Mode$_B$	Port B	Port C$_L$

Q.9 Write a code (part of the program) to enable all but RST 6.5 interrupt. [2]

D7	D6	D5	D4	D3	D2	D1	D0
SOD	SDE	XX	R7.5	MSE	M7.5	M6.5	M5.5

Q.10 A 2kHz square wave has to be generated using Counter-0 of 8254 peripheral interface device. The addresses for this device are as follows: CWR: F3, CNT-2: F2, CNT-1: F1 and CNT-0: F0H. The clock frequency is 5MHz and gate signal is always high. Identify appropriate control word and count value and write suitable instructions with comments to generate the desired square waveform. [5]

D7	D6	D5	D4	D3	D2	D1	D0
SC1	SC0	RW1	RW0	M2	M1	M0	BCD