Faculty of Computing and Technology

Department of Computing

Bachelor of Science (Hons) in Computer Science & Software Engineering

End - Semester Examination

Year 2023, Semester 01 -Batch 01

CS/SE 1104– Computer Architecture and Organization

Duration: 02 Hours

Instructions to the candidates:

1. Answer the all the questions.
2. Clearly write the all the calculations where they needed.
3. The total number of marks allocated will be 100.

Question 1

Since humans use decimal notation and computers use binary notation, number conversion is of paramount importance to how computers represent numbers.

a) Using the following numbers (show all your working): (06 Marks)

   I. 1356, show how a decimal number can be converted to binary.

   II. 1011100111, show how a different binary number can be converted to decimal.

b) Using the following numbers (show all your working without going via decimal): (06 Marks)

   I. 1011111000, show how a binary number can be converted to octal.

   II. 1110001111, show how a binary number can be converted to hexadecimal.

c) Explain why it is important that, when using the methods described in part (b), the conversion starts at the least significant bit? (04 Marks)

d) Convert 192.168 to binary. (03 Marks)

e) Draw a logic circuit for the following functions: (06 Marks)

I. $F(X,Y,Z) = XY' + XZ' + YZ$

II. $F(X,Y,Z) = (X + Y')(X' + Z')(Y + Z)$

[Total 25 Marks]

Question 02

a) Explain and differentiate between physical, virtual, and logical memory. (06 Marks)

b) Why is main memory not suitable for permanent program storage or backup purposes? (03 Marks)

c) Combinational logic can be used to build several computer circuits relating to maths. (06 Marks)

A key device needed for computational functions is a full adder. Describe from first principles how to build a full adder which adds two-bits and a carry.

d) Another useful circuit is a shift register. Using D-type flip flops show how to build a four-bit shift register and explain how it works. There is no need to show the individual gates inside the D-type flip flops. (06 Marks)

e) What do the terms "8-bit" microprocessor, or "32-bit" microprocessor mean? (04 Marks)

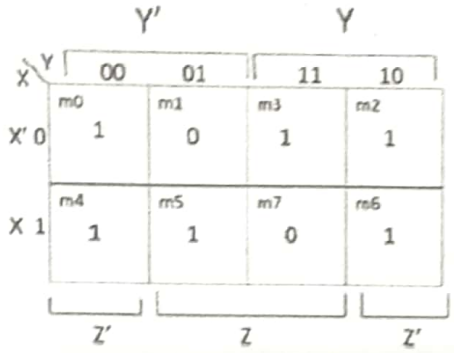
[Total 25 Marks]

Question 03

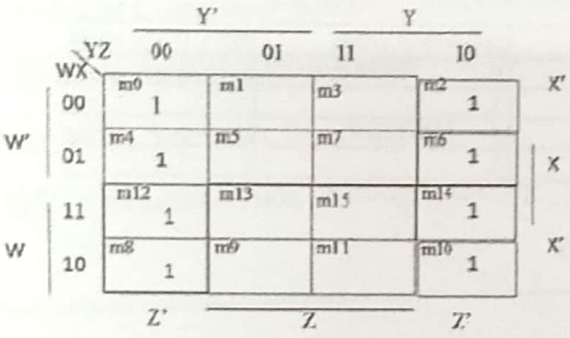
a) With the aid of a diagram, explain the operation of a computer's CPU at the level of registers, functional units, and buses.
You must provide a diagram of the structure of a computer and explain how an instruction is executed in terms of the flow of information between registers and functional units. (03 Marks)

b) Generate the function F for the following K-maps: (10 Marks)

I.



II.



c) Simplify the following functions where D is a don't care function: (12 Marks)

I. $F(X,Y,Z) = \sum(0,3,4)$

$D(X,Y,Z) = \sum(2,6)$

II. $F(W,X,Y,Z) = \sum(0,1,3,5,9,11)$

$D(W,X,Y,Z) = \sum(2,4,8,10)$

[Total 25 Marks]

Question 04

All digital systems are constructed from two types of components: combinational logic element (i.e. gates) and sequential elements (i.e. flip flops).

a) Describe the fundamental difference between these TWO circuit elements and explain why both types are needed to construct a digital computer. (05 Marks)

b) Explain the difference between the following flip-flops: (06 Marks)

I. D flip-flop;
II. JK flip-flop;

c) Show how flip-flops can be used to construct EITHER: (04 Marks)
I. a shift right register; or
II. a binary counter.
Construct only ONE of these circuits.

d) Complete the following table for T flip-flop. (10 Marks)

T	Q(*t*) present output	Q(*t* + 1) next output
0	0	
0	1	
1	0	
1	1	

[Total 25 Marks]

********** **End Paper** **********