



University of Sri Jayewardenepura

B.Sc. (General) Degree First Year
First Semester Terminal Course Unit Examination – June, 2018

CSC 106 1.5 Computer System Organization
(Time: 1 ½ hours)

This paper consists of three (3) questions on two (2) pages.
Answer all questions.

Question 01 [A total of 35 Marks]

- (a) Perform the following arithmetic operations in 8-bit registers using signed-2's complement form for negative numbers.

(i) $(-110)_2 + (-1011)_2$.

(ii) $(-11001)_2 - (1100111)_2$

[10 Marks]

- (b) In a scheme to represent positive and negative floating-point binary numbers in 16-bit registers, 6 bits are allocated for the exponent. Further, there is an extra bit for the sign of the exponent. The mantissa gets 8 bits, and the remaining bit is for the sign of the number.

- (i) What is the largest positive number that can be represented using the above scheme?

- (ii) Suppose that one bit taken from the mantissa and is given to the exponent. Approximately how many times would the largest positive number in part (i) above be increased due to this change?

- (iii) Show the bit configuration when decimal 25 is represented in the 16-bit register before and after the change.

[18 Marks]

- (c) Consider the specifications given below pertaining to a formatted hard disk.

Total number of cylinders: 62,260
Number of tracks in a cylinder: 255
Total number of sectors: 1,000,206,900
Size of a sector in bits: 4096

Calculate the number of sectors in a track, total number of tracks, and the capacity of the disk in gigabytes.

[07 Marks]

Question 02 [A total of 20 Marks]

- (a) What are the types of busses used to describe the processor width? Which one of these busses does restrict the amount of data that can be transferred from memory to processor? [05 Marks]
- (b) Describe the progression of computers from mainframe to warehouse-scale computers. [05 Marks]
- (c) Explain the role of BIOS in a computer system. [05 Marks]
- (d) Briefly explain the advantages and disadvantages of low-level languages over high-level languages. [05 Marks]

Question 03 [A total of 45 Marks]

- (a) What is multiplexer circuit? Draw the block diagram of a 4 by 1 multiplexer circuit. [05 Marks]
- (b) Simplify the following Boolean function using the rules of Boolean algebra.

$$f = (a + b)(b + c)(c + d')$$

- (i) Draw the logic diagram of simplified f .
- (ii) Implement f using a 4 by 1 multiplexer circuit alone.
- (iii) Implement f using a 2 by 1 multiplexer circuit alone.

[20 Marks]

- (c) Consider the Boolean function f defined in Table 3.1.

a	b	c	d	f
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1

a	b	c	d	f
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1

Table 3.1

- (i) Using Karnaugh maps along with "Don't care" values, simplify the above Boolean function.
- (ii) Suppose that a combination of **NAND** / **NOR** gates, amounting to a total of 6 gates, are available. Implement f using the available gates.

[20 Marks]

*** End of Paper ***