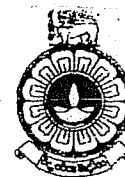


THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
B. SC. DEGREE PROGRAMME 2012/2013
FINAL EXAMINATION
CSU2178: DIGITAL COMPUTER FUNDAMENTALS
DURATION: TWO HOURS (2 HOURS)



Date: 19th December, 2013

Time: 9.30 am to 11.30 am

Answer **FOUR** Questions **ONLY**.

Q1

- a) Convert the following **binary** numbers in to **octal** and **hexadecimal**.
 - i. 101011001010_2
 - ii. 1000100.011_2
- b) Briefly describe the followings.
 - i. Radix number system
 - ii. EBCDIC character set
 - iii. Unicode character set
- c) Draw the truth table and logic circuit diagram of the **full adder circuit**.

Q2

- a) Write short notes on the following combinational circuits.
 - i. Multiplexer
 - ii. Counters
 - iii. Registers
- b) Implement 8-to-1 multiplexer by using only 2-to-1 multiplexers. (Use the block diagrams of multiplexers.)
- c) Consider the truth table given in Fig 2.1.
 - i. Write a Boolean expression for the output **F**.
 - ii. Implement the function **F** by using **16-to-1 multiplexers** only.

A	B	C	D	F
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Fig 2.1

Q3

a) Briefly describe the followings.

- i. The Von-Neumann Model
- ii. The System Bus Model
- iii. Fetch-Execute cycle
- iv. The memory hierarchy of a computer

b) What are the advantages and disadvantages of Assembly language?

- c) Consider the following **assembly language program**. Explain the task of each line of codes in the program.

```

1  ! This program adds two numbers

2          begin

3          Org 2048

4  Pro1: Ld [r1] , % X 1

          Ld [r2] , % X 2

          Addcc % X 1, % X 2, X 3

          St % X 3, [r3]

5          end

```

Q4

- a) Briefly describe the following flip flops using appropriate truth tables and circuit diagrams.
- i. S-R flip flop
 - ii. T- flip flop
 - iii. J-K flip flop
- b) Design a **four (04) bit Register** using J-K flip flops.
- c) What are the differences between **synchronous counters** and **asynchronous counters**?

Q5

- a) Simplify the following Boolean equations using Boolean algebraic method. (Laws)

$$\text{i. } P = \overline{A} \overline{B} \overline{C} + \overline{A} B C + A B \overline{C} + A \overline{B} C$$

$$\text{ii. } Q = \overline{A} \overline{B} C D + \overline{A} B C D + A B C D + A \overline{B} C D$$

- b) Use the **K'Map** method to simplify the Boolean equation

$$S = A \overline{B} \overline{C} D + \overline{B} D + \overline{B} \overline{C} \overline{D} + B C D + \overline{A} \overline{B} C D + A \overline{B} C D$$

- c) Draw the logic circuit diagram of the simplified Boolean equation in (b)

Q6

- a) Briefly describe the followings.
 - i. The memory hierarchy
 - ii. Disk file system
 - iii. Direct mapped cache
- b) Draw a 2 bit register with **Enable (EN)**, **Clock (CLK)** and **Write (WR)** controls.
- c) Design a **four-word by eight-bit RAM** by using **four-word by four-bit RAMs**.

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