THE OPEN UNIVERSITY OF SRI LANKA

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

B. SC. DEGREE PROGRAMME 2015/2016

FINAL EXAMINATION

CPU3141: DIGITAL COMPUTER FUNDAMENTALS

DURATION: TWO HOURS (2 HOURS)

Date: 02.01.2017 **Time: 1.30 pm – 3.30 pm**

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

Q1.

(i) What are the advantages of binary number system to the digital computer? (List 3)

(ii) Convert the following **decimal numbers** into **binary** and **hexadecimal.**

a) 23_{10}

b) 167.2_{10}

c) -85_{10}

(iii) Describe what is **BCD** and represent $\mathbf{653_{10}}$ in **BCD**.

(iv) Briefly discuss about ASCII representation in digital computers.

Q2.

(i) Name three (03) Boolean algebraic rules and prove them.

(ii)

a. Use the following truth table to derive **POS** term for the output X

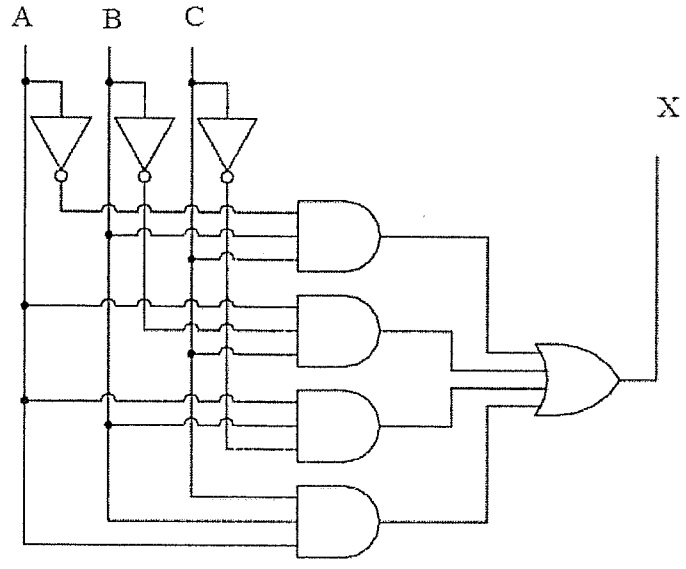
b. Simplify the above POS term using **Boolean algebraic rules.**

A	B	C	D	X
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

(iii) Consider the following **Logic Circuit.**

a. Simplify the circuit using **K-Map** (Karnaugh Map).

b. Draw the simplified circuit diagram using appropriate logic gates.



Q3.

(i) Draw the truth table and the logic circuit for a **Full Adder**.

(ii) Multiplexer is a device that selects between numbers of signals.

a. Draw the truth table for a **2-to-1 Multiplexer**.

b. Draw the logic circuit for the **2-to-1 Multiplexer**.

(iii) Briefly discuss about **Parity Checkers and Encoders**.

Q4.

(i) Discuss the difference between combinational logic and sequential logic. (Use named block diagrams).

(ii) Describe the function of the **Master-Slave JK flip-flop**. (Use block **diagrams.**)

(iii) Describe the function of a Shift **Register** using a block diagram of any one of the four types of Shift Registers?

(iv) Draw the **timing diagram** for the **four bit synchronous counter**.

Q5.

(i) List five (05) properties of **Asynchronous Sequential Circuits.**

(ii) What is **Race Condition**? Explain with examples.

(iii) Draw the **block diagram** and **truth table** for an **asynchronous decade counter**.

(iv) Discuss **four (04) advantages** of **asynchronous counters**.

Q6.

(i) What are the steps the **Central Processing Unit** perform for each instruction once the necessary data and instruction are in memory?

(ii) How does data and instructions are transferred from an input device into the memory?

(iii) ***Reads*** dominate processor cache accesses. All instruction accesses are *Reads*. What are the ***Read*** **policies**, and briefly describe them.

(iv) Describe how the **CPU (Central Processing Unit)**, in association with the **memory,** executes a computer program.