SOUTH EASTERN UNIVERSITY OF SRI LANKA
FIRST EXAMINATION IN BACHELOR OF INFORMATION AND COMMUNICATION TECHNOLOGY - 2018/2019
SEMESTER – I, AUGUST 2021

CIS11032 – Logic Designing & Computer Organization

Answer all Questions **Time Allowed: 02 hours.**

INSTRUCTIONS:

- ***Use of calculators is allowed.***
- ***It is compulsory to show detailed steps wherever necessary.***
- ***Total Number of Questions: 04***

Question 01:

a) Convert the following numbers to their hexadecimal equivalent.

I. 1111011101_2

II. 657_8

III. 1111_8

IV. 256_{10}

(20 Marks)

b) Represent -12 in

I. 8-bit Signed One's Complement Notation

(10 Marks)

II. 8-bit Signed Two's Complement Notation

(10 Marks)

c) Represent 121.0625 in IEEE 754 Single-precision binary floating-point format.

(20 Marks)

d) Law of Absorption states that $A + AB = A$

I. Prove the above theorems using Perfect Induction Method.

(20 Marks)

II. Using Boolean Algebraic Laws, show that,

$$ABC + AB\bar{C} + \bar{A}BC + C = AB + C$$

(20 Marks)

[Total 100 marks]

Question 02:

You are supposed to design a logic circuit to detect the multiples of 3 (i.e., the numbers that are perfectly divisible by 3 without any remainder) between 0 and 15.

- The circuit has 4 inputs (A, B, C, and D) with an output F.
- The output F = 0 when the input is 0.
- The output F=1 when the number at the input is a multiple of 3. Otherwise, the output F = 0.

a) Obtain the truth table for the above circuit.

(25 Marks)

b) From the truth table, derive the logic equation of the circuit in SOP (Sum-of-Product) form.

(25 Marks)

c) Simplify the equation obtained in part b) using a K-Map.

(25 Marks)

d) Draw the logic circuit for the simplified equation.

(25 Marks)

[Total 100 marks]

Question 03:

a) Explain the following statement with proper example:

"The use of a dedicated bus line brings high throughput to the system than using a time multiplexed bus line."

(25 Marks)

b) Explain why a disk is considered as a combination of random access and sequential access memory.

(25 Marks)

c) Draw a Memory Hierarchy Diagram to arrange the following memory devices:

Hard disk, DVD, USB Pen drive, DDRAM, L1 Cache, Instruction Register, Video tape, and L3 Cache.

(25 Marks)

d) Explain how a centralized arbitration differs from a distributed arbitration.

(25 Marks)

[Total 100 marks]

Question 04:

Common Cache Replacement Algorithms in practice are **First-in-First-out, Least Recently Used and Least Frequently Used**.

a) Apply the Least Recently Used algorithm to the following cache entry if the number of frames = 3

7, 0, 1, 2, 0, 3, 5, 0, 1, 2, 0, 0, 2, 1, 7, 1, 2

(25 Marks)

b) Apply Least Frequently Used algorithm to the same cache entry in Question 04 a) with same number of frames.

(25 Marks)

c) Evaluate the best replacement algorithm based on Hit Ratio.

(25 Marks)

d) What is Belady's anomaly? Check if Belady's Anomaly occur for the following cache entry, if the number of frames is increased from 3 to 4 using First-in-First-out algorithm.

7, 0, 1, 2, 0, 5, 0, 1, 7, 5, 1

(25 Marks)

[Total 100 marks]

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