INSTITUTE OF TECHNOLOGY TRALEE

SUMMER EXAMINATIONS 2011/2012

COMPUTER ARCHITECTURE

Module Code: COMP 61003
CRN: 43828

External Examiner: Mairead O Sullivan
Internal Examiner: Damien Gordon **Duration: 2 Hours**

Instructions to Candidates: Answer any *three* questions

Question One *(33 Marks)*

(i) Convert the decimal number 62 to its binary **and** hexadecimal equivalent. *(8 Marks)*

(ii) Show the logic symbol **and** the truth table for: *(8 Marks)*

(i) AND gate (2 input) (ii) XNOR gate

(iii) Complete the truth table for the expression below: *(9 Marks)*

$$Z = \overline{A}BC + (C \oplus D)$$

(iv) Draw the circuit for the expression below: *(8 Marks)*

$$Z = AB\overline{D} + \overline{C + D}$$

Question Two ***(33 Marks)***

(i) Write an expression for the circuit given below:

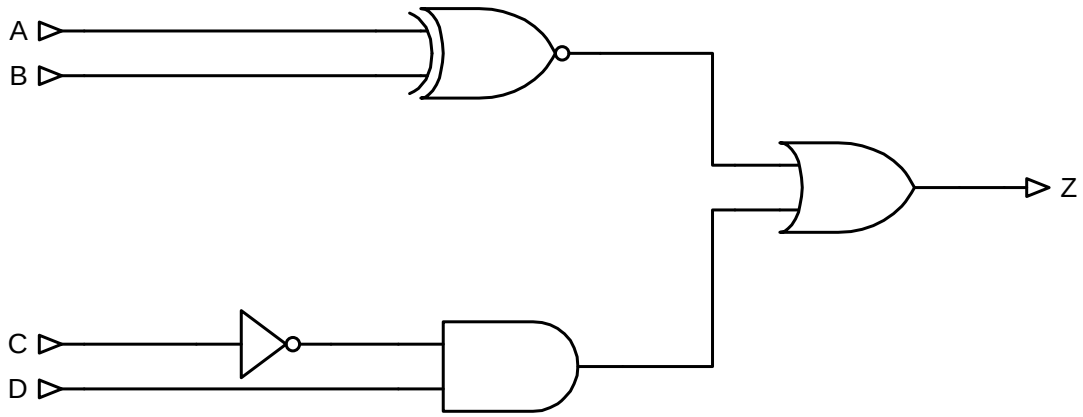

Figure 1

(9 Marks)

(ii) A majority function of three inputs is TRUE when two or more inputs are TRUE. Use A, B, C as the inputs and let the result be M

(a) Do the truth table for M
(b) Write the Equation for M and simplify
(c) Draw the circuit in its most simplified form.

(12 Marks)

(iii) Write an expression for Z below. Simplify the expression if possible and draw the circuit.

(12 Marks)

A	B	C	**Z**
0	0	0	**0**
0	0	1	**1**
0	1	0	**0**
0	1	1	**0**
1	0	0	**0**
1	0	1	**1**
1	1	0	**1**
1	1	1	**1**

Question Three *(33 Marks)*

(i) Show the truth table for the Full-Adder. Hence or otherwise, write the equation for the Full-Adder and show the logic circuits required to implement it.

(12 Marks)

(ii) Demonstrate how several Full-Adders can be connected to form a four-bit adder.

(10 Marks)

(iii) Write a short note on Random Access Memory (RAM), discussing Static-RAM and Dynamic-RAM and highlighting the differences between them. How does ROM differ from RAM?

(11 Marks)

Question Four *(33 Marks)*

(i) Draw a block diagram of a generic CPU, and write a short paragraph describing the function of each component.

(12 Marks)

(ii) Write a note on the *Instruction Cycle* of the CPU.

(10 Marks)

(iii) Show how four flip-flops can be connected to form a serial-in parallel-out register. Show how 1101 would be loaded and read from such a register.

(11 Marks)

Rules of Boolean Algebra

1	$A + O = A$
2	$A + 1 = 1$
3	$A . O = O$
4	$A . 1 = A$
5	$A + A = A$
6	$A + \overline{A} = 1$
7	$A . A = A$
8	$A . \overline{A} = O$
9	$\overline{\overline{A}} = A$
10	$A + AB = A$
11	$A + \overline{A}B = A + B$
12	$(A + B)(A + C) = A + BC$

Laws of Boolean Algebra

Commutative	$A + B = B + A$ $AB = BA$
Associative	$A + (B + C) = (A + B) + C$ $A(BC) = (AB)C$
Distributive	$A(B + C) = AB + AC$