



INSTITUTE OF TECHNOLOGY - TRALEE

SUMMER EXAMINATIONS AY 2012 - 2013

Computer Architecture

COMP61003

CRN 43828

External Examiner: Mr. Michael Godley
Internal Examiner: Ms. Mairead O'Sullivan

Duration of Exam: 2 hours

Instructions to Candidates: Answer any three questions.

Question One

(33 Marks)

- (i) Convert the binary number 10111100 to its decimal **and** hexadecimal equivalent. (8 Marks)
- (ii) Show the logic symbol **and** the truth table for: (8 Marks)
- (i) NAND gate (2 input) (ii) XOR gate
- (iii) Complete the truth table for the expression below: (9 Marks)

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

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

$$Z = \overline{A}\overline{C} + \overline{B \oplus D}$$

Question Two

(33 Marks)

- (i) Write an expression for the circuit given in *Figure 1*:

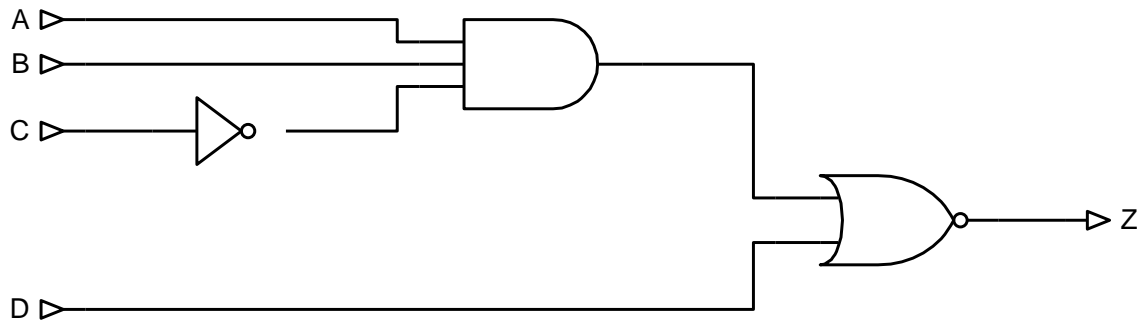


Figure 1

(9 Marks)

- (ii) A minority function of three inputs is TRUE when two or more inputs are FALSE.

Use A, B, C as the inputs and let the result be M

- Do the truth table for M
- Write the Equation for M and simplify
- 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	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

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 a Full-Adder can be composed from two half adders and some additional logic. Use a diagram to support your answer.
(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) Name the buses associated with a CPU. Explain the function and direction of each bus.
(12 Marks)
- (ii) Write a note on the *Instruction Cycle* of the CPU.
(12 Marks)
- (iii) Show how four flip-flops can be connected to form a serial-in serial-out register. Show how 1100 would be loaded and read from such a register.
(11 Marks)

Rules of Boolean Algebra

1	$A + 0 = A$
2	$A + 1 = 1$
3	$A \cdot 0 = 0$
4	$A \cdot 1 = A$
5	$A + A = A$
6	$A + \overline{A} = 1$
7	$A \cdot A = A$
8	$A \cdot \overline{A} = 0$
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	$A(B + C) = AB + AC$