



INSTITUTE OF TECHNOLOGY - TRALEE

AUTUMN EXAMINATIONS AY 2012 - 2013

## Computer Architecture

**COMP61003**

**CRN43829**

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

**Duration of Exam:** 2 Hours

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**Instructions to Candidates:** Answer any three questions.

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### **Question One**

**(33 Marks)**

- (i) Convert the binary number 101011 to its decimal **and** octal equivalent. (8 Marks)
- (ii) Show the logic symbol **and** the truth table for: (8 Marks)
- (i) AND gate                      (ii) XOR gate
- (iii) Complete the truth table for the expression below: (9 Marks)

$$Z = \overline{AC} + \overline{B + D}$$

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

$$Z = \overline{ACD} + \overline{B}$$

## Question Two

(33 Marks)

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

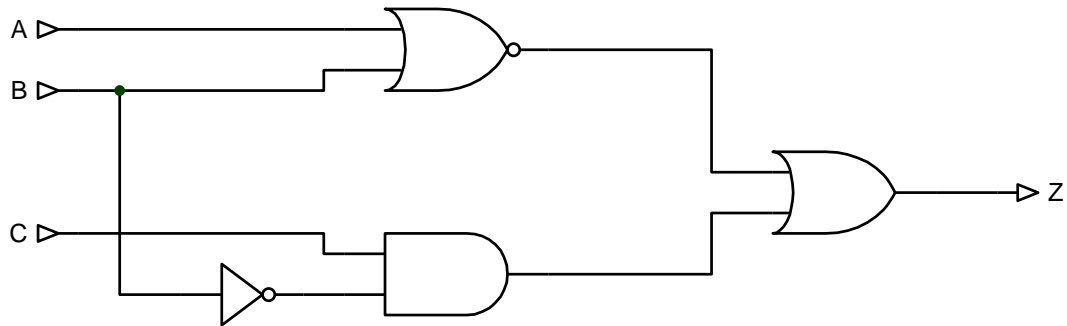


Figure 1

(10 Marks)

- (ii) Simplify the following:

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

(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	1
0	0	1	0
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 Half-Adder. Hence or otherwise, write the equation for the Half-Adder and show the logic circuits required to implement it.  
(12 Marks)
- (ii) Explain how a Full-Adder can be derived from two Half-Adders and some logic circuitry. Use diagrams 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) 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.  
(12 Marks)
- (iii) Show how four flip-flops can be connected to form a parallel-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	$A(B + C) = AB + AC$