# INSTITUTE OF TECHNOLOGY TRALEE

## Semester 2 Examinations 2010

## Computer Architecture
## (CRN 43828)

**Internal Examiners:** **Ms Mairead O'Sullivan**
**External Examiner:** **Dr Barry Feeney**

**Duration:** **2 Hours**

**Instructions to Candidates:** **Answer any THREE Questions.**

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***Question One*** ***33 Marks***

(a) Convert the decimal number 73 to its binary **and** hexadecimal equivalent. *(8 Marks)*

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

(i) NOR gate (2 input) (ii) Inverter

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

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

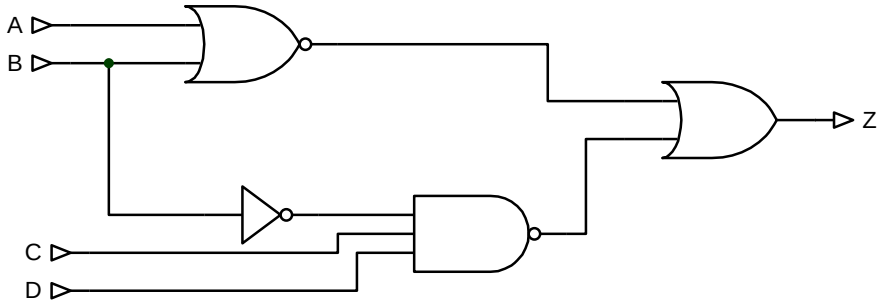
(d) Draw the circuit for the expression below: *(8 Marks)*

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

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

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

*(10 Marks)*




(b) Simplify the following expression:

$$Z = A(A.1 + AB + \overline{A}CD) + B(D + \overline{C}D + 1)$$

*(1 Marks)*

(c) 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 | **1** |
| 0 | 1 | 0 | **0** |
| 0 | 1 | 1 | **0** |
| 1 | 0 | 0 | **1** |
| 1 | 0 | 1 | **1** |
| 1 | 1 | 0 | **0** |
| 1 | 1 | 1 | **1** |

## *Question Three* *(33 Marks)*

(a) 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*)

(b) How many locations in memory can be addressed by a CPU which has a 32-bit address bus.

*(10 Marks*)

(c) 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)*

(a) Name the buses associated with a CPU. Explain the function and direction of each bus.

*(12 Marks*)

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

*(11 marks)*

(c) Write a note on the *Instruction Cycle* of a CPU. Support your answer using a diagram.

*(10 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 | $A + B = B + A$<br>$AB = BA$ |
| Associative | $A + (B + C) = (A + B) + C$<br>$A(BC) = (AB)C$ |
| Distributive | $A(B + C) = AB + AC$ |