Institiúid Teicneolaíochta, Trá Lí
INSTITUTE OF TECHNOLOGY - TRALEE

AUTUMN EXAMINATION, 2011
AY 2010/2011

COMPUTER ARCHITECTURE
CRN: 43829

Internal Examiner: Ms. M. O'Sullivan
External Examiner: Dr. B. Feeney

Duration of Exam: **2 HOURS**

Instructions to Candidates: *Answer* **ANY THREE** questions.

Question One *(33 Marks)*

(i) Convert the decimal number 76 to its binary **and** hexadecimal equivalent. *(8 Marks)*

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

(i) NOR gate (ii) AND gate

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

$$Z = \overline{A}C + \overline{BD}$$

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

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

Question Two *(33 Marks)*

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

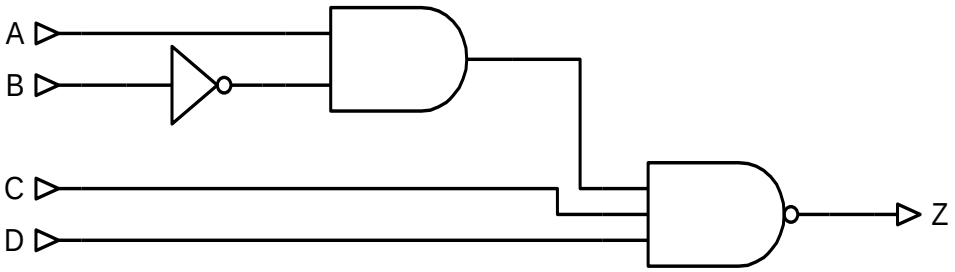

Figure 1

(10 Marks)

(ii) Simplify the following expression:

$$Z = X(X + \overline{X}Y) + X(X.0 + 1) + \overline{Y}$$

(11 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	**1**
0	1	0	**0**
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) Show how a Full-Adder is composed of two Half-Adders and some extra circuitry.

(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) If a CPU clock operates at 2.3 GHz, what is the cycle length expressed in nano-seconds.

(12 Marks)

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

(11 marks)

(iii) Write a note on Cache Memory.

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