National College of Ireland

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B.Sc. (Honours) in Business Information Systems – Full-time – Year 1 – BSHBIS1
B.Sc. (Honours) in Business Information Systems – Part-time – Year 1 – BSHBISE1
B.Sc. (Honours) in Computing – Full-time – Year 1 – BSHC1
B.Sc. (Honours) in Computing – Part-time – Year 1 – BSHCE1
Higher Certificate in Computing – Full-time – Year 1 – HCC1
Higher Certificate in Computing – Part-time – Year 1 – HCCE1

Semester Two Examinations – 2016/2017

Thursday 11th May 2017
10.00am – 11.30am

Computer Architecture

Dr. Rob Brennan
Dr Jennifer McManis
Dr Hugh O Donnell
Dr. Paul Hayes
Mr. David Tracey
Mr. Glen Ward

Answer **Question 1** and **One** other question

Standard calculators only are permitted

Commence each answer on new page

Duration of exam: 90 minutes
Attachments: Boolean Algebra Identities

Question 1. COMPULSORY (Answer ALL Parts) 60 Marks

(1) Distinguish between Assembly Language and Machine Code in terms of running computer programs on a processor.

(10 Marks)

(2) Describe the process of converting 2-byte Hexadecimal numbers into binary numbers using the Hexadecimal number A53C as an example.

(10 Marks)

(3) John Mauchley and J. Presper Eckert developed an an electronic computer called the ENIAC. Briefly describe some key features of the ENIAC machine.

(10 Marks)

(4) Demonstrate by means of truth tables that the AND form of the Absorption Law is correct, that is:

$$X(X + Y) = X$$

(10 Marks)

(5) Draw a Finite State Machine for the following language:

$$L = \{a, aab, aba, abb\}$$

(10 marks)

(6) Outline the process of representing a negative decimal number as an eight-bit binary number using twos-complements. Illustrate the process using the decimal number -37 as an example.

(10 marks)

Answer Question 2 or Question 3.

Question 2. (Answer ALL Parts) 40 Marks

The following boolean functional expression describes a digital component that is part of the control system used by an Irish company that manufactures Steel Pipes.

$$F = XY + YZ(Y+Z)$$

(1) Draw the logic diagram that represents this digital component. Assume only single input and dual input logic gates are used.

(10 marks)

(2) Create a truth table based on this functional expression.

(10 marks)

(3) Using the basic identities of boolean algebra simplify the functional expression so that the component is optimal. The basic identities are listed in Appendix A.

(10 marks)

(4) By means of truth tables demonstrate De Morgan's Second Law ie. (AB)' = A' + B'

(10 Marks)

Question 3. (Answer ALL Parts) 40 Marks

(1) Describe the major invention that was at the heart of the PDP-8 machine using a diagram to support your answer.

(10 marks)

(2) Explain what BIOS stands for and briefly describe some of its main functions.

(10 marks)

(3) There are a number of internal CPU characteristics that affect performance. Outline at least 3 of these.

(10 marks)

(4) Outline the properties of four different system clock attributes.

(10 marks)

Appendix A: Basic Identities of Boolean Algebra

Identity Name	AND Form	OR Form
Identity Law	$1x = x$	$0+x = x$
Null (or Dominance) Law	$0x = 0$	$1+x = 1$
Idempotent Law	$xx = x$	$x+x = x$
Inverse Law	$x\bar{x} = 0$	$x+\bar{x} = 1$
Commutative Law	$xy = yx$	$x+y = y+x$
Associative Law	$(xy)z = x(yz)$	$(x+y)+z = x+(y+z)$
Distributive Law	$x+yz = (x+y)(x+z)$	$x(y+z) = xy+xz$
Absorption Law	$x(x+y) = x$	$x+xy = x$
DeMorgan's Law	$\overline{(xy)} = \bar{x}+\bar{y}$	$\overline{(x+y)} = \bar{x}\bar{y}$
Double Complement Law	$\bar{\bar{x}} = x$	