National College of Ireland

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BSc (Hons) in Business Information Systems – Full-time – Year 1 – BSHBIS 1
BSc (Hons) in Business Information Systems – Part-time – Year 1 – BSHBISE 1
BSc (Hons) in Computing – Full-time – Year 1 – BSHC 1
BSc (Hons) in Computing – Part-time – Year 1 – BSHCE 1
Higher Certificate in Computing – Full-time – Year 1 – HCC 1
Higher Certificate in Computing – Part-time – Year 1 – HCCE 1
Certificate in Computing – Part-time – Year 1 – CIC 1

Semester Two Examinations – 2015/2016

Friday 6th May 2016
10.00am – 11.30am

Computer Architecture

Dr. Rob Brennan
Dr Jennifer McManis
Dr. Paul Hayes
Mr. Eamon Nolan
Dr. Arghir Moldovan
Mr. David Tracey

Answer **Question 1** and **One** other question
Standard non-programmable calculators 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) Describe the process of converting hexadecimal numbers into binary numbers using the hexadecimal number AB as an example.

(10 Marks)

(2) Discuss the technical advancements that sparked the first three generations of Computer Systems.

(10 Marks)

(3) Demonstrate how the following decimal numbers would be converted into their binary representations: 34, 251.

(10 Marks)

(4) Using truth tables, prove that in Boolean algebra $AD + AD = AD$.

(10 Marks)

(5) How much memory would it take to store the following statement in a raw text file:

I wandered lonely as a cloud

(10 Marks)

(6) John Von Neumann is highly regarded as one of the leaders of Computer Science, and his IAS machine is architecturally similar to modern computers. Illustrate by means of a diagram the basic schematic of the Von Neumann machine.

(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 Ice Cream.

$$F1 = \overline{(A + B)}(A.B + C + \bar{A}.\bar{B})$$

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

(10 marks)

(2) 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)

(3) Using truth tables show that the functional expression above is equivalent to the new optimised expression you have derived.

(15 marks)

(4) What is the percentage saving in numbers of logic gates between the original component and the new optimised component?

(5 marks)

Question 3. (Answer ALL Parts) 40 Marks

(1) The PDP-8 machine had a major invention. Describe this major invention using a diagram to support your answer.

(10 marks)

(2) Differentiate between a true UPS system and an SPS system.

(10 marks)

(3) Discuss the relationship between the BIOS and the CMOS.

(10 marks)

(4) List and describe four 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	$\bar{\bar{x}} = x$	