OLLSCOIL NA hÉIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

AUTUMN EXAMINATION 2001

First Computer Science

CS1020: Computer Systems I

Professor J.G. Hughes
Professor C.J. Sreenan
Dr. B.A. O'Sullivan

Instructions
Answer all questions

3 Hours

1. (a) Explain any 3 of the following, making use of suitable examples:
   i. Illustrate how to structure a web-page using the HTML, HEAD and BODY tags.
   ii. Illustrate how a table can be defined in HTML
   iii. Illustrate how a CLASS rule can be defined in a style-sheet and used in a
   iv. What is a Uniform Resource Locator? web-page;

   (*6 marks*)

   (b) Develop a simple well-structured web-page, with a style-sheet incorporated into it, which has examples of the following: (Note that any rendering should be handled using style-sheet rules.)
   - Give you document the title **CS1020 Answer**.

- A background image – you should use an image file which is located at `http://www.images.com/background.gif`;
- Write a style-sheet rule which ensures that all headings that you use in your web-page appear in the colour red.
- The body of your document should have a main heading **Welcome to my web-page**. This section should contain two subsections, each introduced by a second-level heading.
- The first subsection, whose heading should be **My Life at UCC**, should contain some text in two paragraphs
- The second subsection, whose heading should be **My Activities at UCC**, should contain an ordered list of at least three of the activities of yours at UCC.
- Incorporate a **mailto** hyper-link which when activated would send an email to your UCC email account.
- Incorporate an image into the bottom of your page which is a hyper-link to **http://www.cs.ucc.ie**. Use the image file **logo.gif** for this purposes (you can assume that this image is in the same directory as your web-page.

(*10 marks*)

(c) Illustrate with an example how you would perform the following under UNIX:

i. View the contents of a directory;
ii. Remove a directory;
iii. Move a file from the current working directory to a sub-directory of the current working directory and give it a different name;
iv. Copy a file from the current working directory to its parent directory;
v. Rename a file.

(*4 marks*)

2. (a) Explain any 3 of the following making use of suitable examples:

i. The Arithmetic Logic Unit (ALU);
ii. What is the relationship between a bit, a byte and a word?
iii. What is meant by the term primary memory?
iv. Explain how a CD is read.

(*6 marks*)

(b) Answer all of the following:

i. Convert the following numbers to binary using both the successive halving method and the powers-of-two method: 17, 33.
ii. What is 10110011 (binary) in decimal? In octal? In hexiadecimal?
iii. Convert the following numbers into 8-bit signed-magnitude, one's complement, two's complement and excess notation: -4, 12.
iv. Perform the following calculations on 8-bit two's complement:
   - The sum of 01010101 and 00011110;
   - The sum of 01010101 and 11111111;
v. How would the results of the calculations of the preceding problem be different is they were performed in one's complement.

(*10 marks*)

(c) **Pipelining** and **superscalar architectures** are approaches which are frequently used to achieve instruction-level parallelism in processors. Explain what is meant by (i) pipelining and (ii) superscalar architectures. What is meant by the term **processor-level parallelism**? *(4 marks)*

3. (a) Explain any 3 of the following, making use of suitable examples:

   i. Explain what is meant by the phrase *circuit equivalence.*

   ii. Explain what is meant by the phrase *bus arbitration.*

   iii. Explain how a *sum of products* representation can be derived from a truth-table;

   iv. Illustrate how NAND Gates can be used to implement and OR Gate, and how NOR Gates can be used to implement and AND Gate. *Please refer to the table of boolean identities attached to this paper.*

   (6 marks)

   (b) Answer all parts:

   i. The output of a two-input Exclusive-OR Gate is true if either of the inputs are true, but not both.

   - Draw the truth-table for the Exclusive-OR Gate;
   - Write a sum-of-products representation of the truth-table;
   - Draw a logic circuit which implements the sum-of-products representation using NAND Gates only.

   ii. Prove the AND form of *De Morgan's Law* of Boolean algebra using a truth-table (perfect induction). *Please refer to the table of boolean identities attached to this paper.*

   (10 marks)

   (c) The 1-bit *Full Adder* can be used to perform binary addition on 2 1-bit numbers. Draw the truth table and circuit diagram for a *Full Adder.* Show how 1-bit full adders can be configured to perform addition on 2-bit binary numbers. *(4 marks)*

4. (a) Explain any 3 of the following, making use of suitable examples:

   i. Discuss how the ISA and microarchitecture levels of a machine interact.

   ii. Give example of, a discuss, some typical instruction types defined at the ISA level of a machine;

   iii. List four addressing modes which are often used at the ISA level of a machine. Give an example of each;

   iv. How do interrupts work at the ISA level of a machine?

   (6 marks)

   (b) Convert the following numbers to IEEE single-precision format. Give your results in hexidecimal:

   i. 2.5,

   ii. 1.25.

   Convert the following IEEE single-precision floating-point numbers from hexadecimal to decimal:

   i. 3F880000,

   ii. 00800000.

   (10 marks)

(c) What do you understand by the terms RISC and CISC? What are the advantages of RISC versus CISC designs? (*4 marks*)

5. (a) The operating system can be regarded as an interpreter. What does this mean? (*5 marks*)

(b) Explain what you understand by the term *segmentation*, in the context of virtual memory organisation. (*5 marks*)

(c) What is an Assembly Language? Explain why assembly language would be used. What are pseudo-instructions? (*5 marks*)

(d) Assembly language statements comprise of four parts: (i) a label (optional) field, (ii) an opcode field, (iii) an operands field, and (iv) a comments field. Explain the contents of each of these fields and illustrate your explanation with some examples. (*5 marks*)

Name	AND form	OR form
Identity law	$1A = A$	$0 + A = A$
Null law	$0A = 0$	$1 + A = 1$
Idempotent law	$AA = A$	$A + A = A$
Inverse law	$A\overline{A} = 0$	$A + \overline{A} = 1$
Commutative law	$AB = BA$	$A + B = B + A$
Associative law	$(AB)C = A(BC)$	$(A + B) + C = A + (B + C)$
Distributive law	$A + BC = (A + B)(A + C)$	$A(B + C) = AB + AC$
Absorption law	$A(A + B) = A$	$A + AB = A$
De Morgan's law	$\overline{AB} = \overline{A} + \overline{B}$	$\overline{A + B} = \overline{A}\,\overline{B}$