

OLLSCOIL NA hÉIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK
COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER EXAMINATION 2002

First Year Computer Science

CS1020: Computer Systems 1

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

Instructions

Answer all questions.

All questions carry equal marks.

This examination is worth 210 marks.

Coursework submitted during term is worth 90 marks.

Calculators may be used.

Please indicate the make and model of your calculator at the start of your exam script.

Duration

3 Hours

1. a) Explain any 3 of the following, making use of suitable examples:
- In Cascading Style Sheets, what is the difference between a CLASS selector and an ID selector?
 - Give an example of how an image can be incorporated into a web-page and hyper-linked so that it uses the `mailto` protocol.
 - In UNIX how can privileges on a file be modified?
 - What is a Uniform Resource Locator? Give examples of a number of protocols which can be used in a URL.

(10 marks)

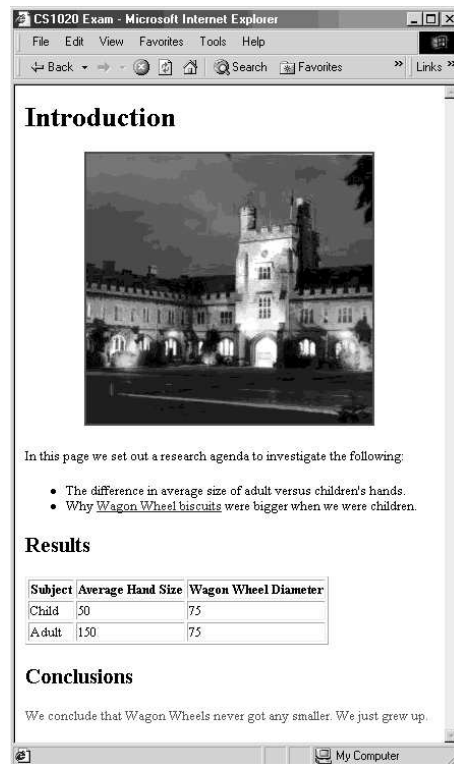


Figure 1: A Simple Web-Page

- b) In Figure 1 a simple web-page is illustrated. In order to implement this web-page do the following:
- Implement a simple *external style-sheet*, and assume it is stored in a file called `cs1020.css` which contains rules for the following:
 - a rule to ensure the background color of the web-page is white;
 - a rule which can be used to centre arbitrary elements in the page;
 - a rule which can be used to colour selected text red to indicate importance.
 - Develop a HTML description of the web-page illustrated in Figure 1 which uses the external style sheet implemented from part (i) which has the following characteristics:
 - the heading **Introduction** is the top-level heading on the page; the headings **Results** and **Conclusions** are of lesser importance
 - the image on the page is centred (using one of your style-rules appropriately) and is linked to the URL `http://www.ucc.ie`
 - the text *Wagon Wheel Biscuits* is linked to the URL `http://www.McVities.com`

- The text of the paragraph under the **Conclusions** heading is marked as *important* (using one of your style-rules appropriately) so that it appears in red.

(22 marks)

- c) Explain the effects of the following UNIX commands. Note that <return> means pressing the Return or Enter key on the keyboard; file1 and file2 are files; www is a directory;

- i. cd <return>
- ii. cd www <return>
- iii. cd /www <return>
- iv. cp file1 file2 <return>
- v. mv file1 file2 <return>
- vi. cp file1 ../www <return>
- vii. chmod u-r file1 <return>

(10 marks)

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

- i. What is an ALU?
- ii. How does *Binary Coded Decimal* representation of a decimal number differ from its true binary representation?
- iii. What is meant by the phrase *instruction level parallelism* in a CPU and how is it achieved?
- iv. What are the differences between a character-map terminal and a bit-map terminal?

(10 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*:
 - 21
 - 17
- ii. Convert the both of the above numbers into octal and hexadecimal.
- iii. Convert the following numbers into 8-bit *signed-magnitude*, *one's complement*, *two's complement* and *excess notation*:
 - -15
 - -10
- iv. The number -200 cannot be represented in any of the formats in part (iii). Why is this the case?

(22 marks)

- c) Memories can be categorised as primary or secondary. With the use of examples, explain the differences between each category. Give examples of how memory is organised *within* a CPU.

(10 marks)

3. a) Explain any 3 of the following, making use of suitable examples:
- Illustrate how a NAND Gate can be used to implement an OR Gate, and how a NOR Gate can be used to implement an AND Gate.
 - What is the difference between the full-adder and half-adder circuit? Explain the difference making use of truth-tables.
 - Memories are available as RAM, ROM, PROM, EPROM. Explain what these are and the differences between them.
 - Explain how an *SR Latch* works. In particular, making use of diagrams, explain what is meant by *State 0* and *State 1* of the latch.

(10 marks)

- b) Consider the following truth-table – having 4-inputs (A,B,C,D) and 2-outputs (X,Y):

A	B	C	D	X	Y
0	0	0	0	0	0
0	0	0	1	0	0
0	0	1	0	0	0
0	0	1	1	0	0
0	1	0	0	0	1
0	1	0	1	1	1
0	1	1	0	0	0
0	1	1	1	1	0
1	0	0	0	0	0
1	0	0	1	0	0
1	0	1	0	0	0
1	0	1	1	0	0
1	1	0	0	0	1
1	1	0	1	1	1
1	1	1	0	0	0
1	1	1	1	1	0

- Derive a Sum-of-Products expression for each output in the truth-table;
- Draw a logic circuit of the Sum-of-Products expressions you have derived.
- Using the Laws of Boolean Algebra (see Table 1 on the last page of this exam paper), show how the truth table in part (b) can be implemented using a pair of AND-Gates – i.e. a single AND-Gate for each output.

(22 marks)

- c) A simple comparator circuit is illustrated in Figure 2, which compares two input words, A and B, each of length 4 bits. Explain how the comparator works, in particular, illustrating how the values of its output are determined.

(10 marks)

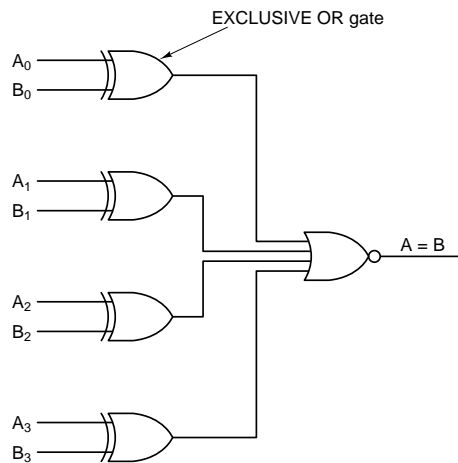


Figure 2: A Simple Comparator Circuit

4. a) Explain any 3 of the following, making use of suitable examples:
- What is a *stack* work? How does it work?
 - Compare RISC and CISC architectures.
 - In the context of controlling the flow of a programme running at the ISA Level of a machine, compare *procedures* with *coroutines*.
 - What is an *addressing mode*? Give examples of a number of modes and distinguish between their usages.
- (10 marks)
- b) i. Convert the following decimal numbers into IEEE 754 format single precision numbers. Give your answer in hexadecimal.
- 4.25
 - -2.125
- ii. Convert the following IEEE 754 format single precision numbers into decimal.
- 3F880000
 - 40B80000
- (22 marks)
- c) Floating point numbers can be used to model the real-number system of mathematics, although there are some important differences. Explain why *overflow errors* and *underflow errors* can occur. Which one is more serious, and why? How does the IEEE FLoating-Point Standard 754 handle overflow and underflow errors?
- (10 marks)
5. a) The operating system can be regarded as an interpreter for certain architectural features not found at the ISA level. Chief among these are *virtual memory*, *virtual I/O instructions* and *facilities for parallel processing*. Briefly explain what is meant by each of the phrases marked in *italics* in the previous sentence.
- (10.5 marks)
- b) Explain how *paging* works. What is the difference between a *page* and a *page frame*? How does paging differ from *segmentation*?
- (10.5 marks)

c) In the context of assembly languages:

- i. What is the difference between an *instruction* and a *pseudo-instruction*?
- ii. What is a *macro*? What is *macro expansion* and how does it work?

(10.5 marks)

d) In the context of the assembly process:

- i. Explain how a *two-pass assembler* works, comparing the function of each phase;
- ii. Explain what is meant by the phrase “*linking and loading*”.

(10.5 marks)

Table 1: Laws of Boolean Algebra

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	$A\bar{A} = 0$	$A + \bar{A} = 1$
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	$\overline{AB} = \bar{A} + \bar{B}$	$\overline{A + B} = \bar{A}\bar{B}$