

SUMMER EXAMINATION 2001

First Computer Science

CS1020: Computer Systems I

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Instructions

Answer all questions

3 Hours

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

- i. Hyper-Text Markup Language (HTML);
- ii. Uniform Resource Locator (URL);
- iii. Incorporating images into an HTML document;
- iv. Style-sheets;

(6 marks)

- (b) Develop a simple web-page, with a style-sheet incorporated into it, which has the following characteristics — an example of how the page should look when rendered using a web-browser is presented in Figure 1. Note that any rendering should be handled using style-sheet rules.

- The *title* of the page is **Question One**;

- The *background colour* of the page is **white** and the text colour is **black**.
- There should be a *large heading* on the page saying **A Heading for Question One** and underneath this heading there should be a horizontal rule;
- There should be a paragraph under the heading which is aligned to the left of the page and whose text colour is blue;
- There should be a table under this paragraph which fits to the width of the browser window. The table should contain 3 rows and 2 columns.
- The heading for the first and second columns are **Text** and **Images**, respectively, both in green.
- The first cell in the second row contains the text *There is a linked image in the next cell*.
- The second cell in the second row contains an image called `logo.gif` which is centered in the cell. When a user clicks on the image a hyperlink to `http://www.ucc.ie` should be activated.
- The first cell in the third row contains the text *This is linked text*. When a user clicks on this text a hyperlink to `http://www.ucc.ie` should be activated.
- The second cell in the second row contains an image called `logo.gif` which is centered in the cell (use the CSS selector `text-align` for this). This image is not hyperlinked.

(10 marks)

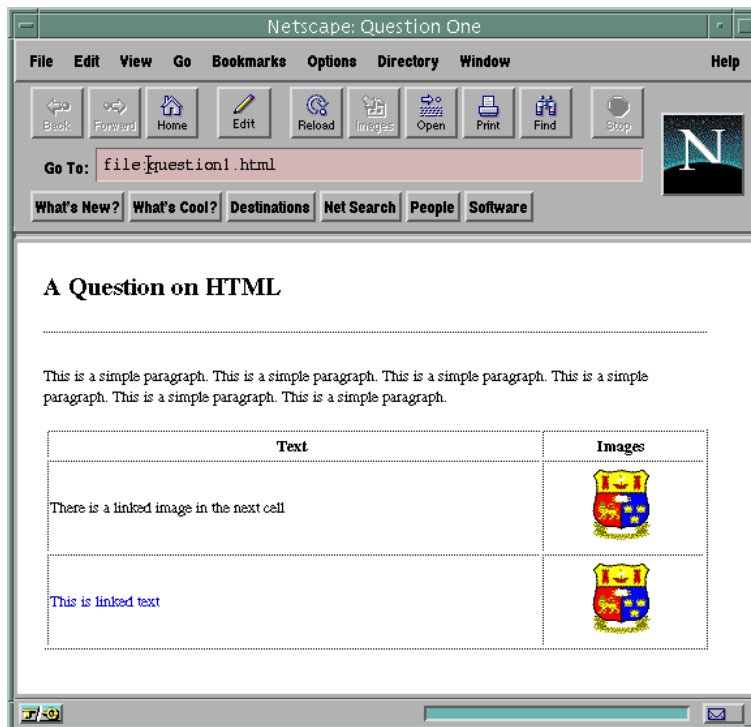


Figure 1: An example of how the page developed in Question 1(b) should look when rendered using a web-browser.

- (c) Illustrate with an example how you would perform the following under UNIX:
- View the contents of a directory;
 - Create a directory;

- iii. Copy a file from the current working directory to a sub-directory of the current working directory;
- iv. Move a file from the current working directory to its parent directory;
- v. Set the access permissions/privileges of a file so that only the owner has read, write and execute access to it;
- vi. Set the access permissions/privileges of a file so that the all users have read-only access to it;

(4 marks)

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

- i. The fetch-execute cycle;
- ii. The character codes ASCII and UNICODE;
- iii. What is meant by the term primary memory?
- iv. Briefly describe four different secondary memory media.

(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: 42, 36.
- ii. What is 1000111001 (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: -9, 34, -17.
- iv. Perform the following calculations on 8-bit two's complement:
 - The sum of 00101101 and 00011110;
 - The sum of 11111111 and 11111111;
- v. How would the results of the calculations of the preceding problem be different if 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. Use suitable examples and contrast where appropriate.

(4 marks)

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

- i. Give the symbols and truth-tables, for no more than two inputs, of the following logic gates: NOT, NAND, NOR, AND, OR, XOR;
- ii. Distinguish between RAM and ROM;
- iii. Boolean Algebra;
- iv. Compare a synchronous bus with an asynchronous bus.

(6 marks)

- (b) Answer all parts:

- i. The **majority function** is a logic function whose output is 0 if the majority of its inputs are 0 and 1 if the majority of its inputs are 1. Show how a logic circuit which implements the majority function could be implemented by answering the following:
 - Draw the truth-table for the majority function;
 - Write a sum-of-products representation of the truth-table;

- Draw a logic circuit which implements the sum-of-products representation.
- ii. Prove the AND form of the Distributive Law or Boolean algebra using a truth-table (perfect induction). (10 marks)
- (c) Draw an **SR Latch** using 2 NOR gates. The latch should have two inputs, S , for Setting the latch, and R for Resetting it. The outputs of the latch should be Q and \overline{Q} . Explain what is meant by *State 0* and *State 1* of a latch. (4 marks)
4. (a) Explain any 3 of the following, making use of suitable examples:
- i. Explain how a stack works;
 - ii. Give example of, a discuss, some typical instruction types defined at the ISA level of a machine;
 - iii. Coroutines;
 - iv. Compare traps and interrupts in the context of the flow of control of a program running at the ISA level of a machine.
- (6 marks)
- (b) Convert the following numbers to IEEE single-precision format. Give your results in hexadecimal:
- i. 4.25,
 - ii. 1.125,
 - iii. 10.
- Convert the following IEEE single-precision floating-point numbers from hexadecimal to decimal:
- i. 40B80000,
 - ii. 3F880000.
- (10 marks)
- (c) What do you understand by the term “addressing mode”? Describe briefly **four** addressing modes found on modern micro-processors. Explain their purpose and how they differ from one another. Include some examples of the addressing modes that you have described. (4 marks)
5. (a) The most important I/O abstraction present at the operating system level is the file. Explain what is meant by a file. Explain how files are organised on a machine. In your answer address such issues as disk allocation, file I/O and directories. (5 marks)
- (b) In operating systems, parallel processing is often supported and is implemented by simulating multiple processors by timesharing a single CPU. Explain what is meant by parallel processing and process synchronisation. (5 marks)
- (c) Virtual memory is an approach to harnessing the capacity of secondary memory as an extension to primary memory. Explain what you understand by the term *virtual memory*. In your explanation compare the paging and segmentation approaches. (5 marks)
- (d) Explain how macros in assembly language are used to assist the specification of a program. How are macros defined? Can macros be parameterised? If so, how? What is meant by macro expansion? (5 marks)