University of Glasgow

Monday, 17th May 2010
2.00 pm – 4.00 pm
(Duration: 2 hours)

DEGREES OF MSci, MEng, BEng, BSc, MA and MA (Social Sciences)

COMPUTING SCIENCE 1Q

(Answer all 4 questions.)

This examination paper is worth a total of 100 marks

(Use SEPARATE ANSWER BOOKS for sections A, B and C)

You must not leave the examination room within the first hour or the last half-hour of the examination.

Section A – Human Computer Interaction

1. **(a)** What is iterative design? Use a diagram in your answer.

[5]

(b) Prototyping can be split into low fidelity and high fidelity approaches. Explain and compare these approaches. In your answer, give at least one example of each approach.

[9]

(c) You have been asked to evaluate the interface to a new TV remote control. The interface will allow users to speak commands, and the remote will use voice-recognition to recognise them and send them to the TV. For example, you might say “Channel 1” and the TV will switch to that channel.

Briefly outline what evaluation by direct observation is. Choose a direct observation technique and describe how you would use it to evaluate the effectiveness of the interface, and what potential problems or dangers you might face in running your evaluation.

[11]

Section B – Information Management

2. **(a)** Draw an Entity-Relationship diagram for the following scenario, indicate clearly all primary keys and the cardinality and totality of all relationships.

Academic staff have unique identification numbers and have singly occupied offices. Students have unique matric numbers and first and last names. Staff and students may have computers, which are uniquely identified by RFID tags. All staff have at least one computer each, whereas only some students have at most one computer. A student may request to borrow a book from the library, several students may request the same book. Each books is uniquely identified by an ISBN number.

[11]

(b) Given a relational database with two tables as follows:

Academic = (Surname:Text, Firstname:Text, Staff-no:Text, Dept:Text)

Course =(Name:Text, Code:Text, Lect-id:Text)

Assume that underlined attributes are primary keys and Lect-id is a foreign key referring to the Staff-no attribute of Academic.

(i) Write an SQL query that returns the surnames of academics in the department of "Basket Weaving".

[2]

(ii) Write an SQL query that returns the firstnames and surnames of lecturers on the "CS1-Q" course.

[4]

(c) Given the following sets: A={1,3,7,9}, B = {2,4,6}, C={7,9}

give the following. Assume that $\wp$ is the powerset operator.

(i) |B|

(ii) $\wp$ (B)

(iii) |$\wp$ (C)|

(iv) B X C

(v) A $\cup$ B

(vi) A $\cap$ C

(vii) Which of the following are true

a. C $\subseteq$ A

b. C $\subseteq$ B

c. <1,2> $\in$ A X B

[8]

Section C: Systems (Section C includes questions 3 and 4)

3. **(a)** Draw a labeled diagram of a simple computer architecture showing how the core components connect together.

[3]

(b) Explain how to represent an image digitally. Why have analogue (film) image representations been generally replaced by digital representations?

[2]

(c) Outline briefly the four principal functions of an Operating System.

[4]

(d) Operating systems have recently migrated from 32bit to 64bit processing architectures and CPU platforms. Explain what advantages this change has brought, citing an example of a type of application program that might benefit.

[1]

(e) You are required to design a circuit which, given an input *xyz* representing a 3 bit binary number *n*, produces an output *abcdef* representing n^2. For example, if the input is 110 ($x = 1$, $y = 1$, $z = 0$), representing $n = 6$, then the output is 100100, representing 36.

(i) Draw a truth table which shows *a, b, c, d, e, f* as functions of *x, y, z*.

[3]

(ii) Draw a Karnaugh map for each of *a, b, c, d, e, f*.

[6]

(iii) Use the Karnaugh maps to work out formulae for *a, b* and *c* in terms of *x, y* and *z*.

[3]

(iv) Draw a diagram of the circuit which calculates *a, b* and *c* from *x, y* and *z*.

[3]

4. **(a)** Explain the term *topology* in the context of computer networks. What is the difference between *circuit switching* and *packet switching* and explain their relative merits?

[5]

(b) Explain the difference between a *domain name* and an *IP address*, giving an example of each.

[4]

(c) Explain in detail the difference between a token ring topology network and a bus topology network, illustrating your answer with diagrams of each of their configurations. Give a detailed account of how they communicate messages between their respective nodes and your view of the relative advantages of each approach.

[10]

(d) In a typical home computer system, all of the user's standard applications programs, such as office suites (including word processing and spreadsheet editors), image manipulation, games and multimedia applications, are usually purchased once and stored on the hard drive. In a new model of computing, users' programs are stored on a central file server and accessed through the internet for a monthly, or annual, fee.

What do you think are the advantages and disadvantages of "owned" applications on local storage compared with "hired" applications on central storage?

[6]