

UNIVERSITY OF EDINBURGH
COLLEGE OF SCIENCE AND ENGINEERING
SCHOOL OF INFORMATICS

Computer Literacy 1

Degree Examination

Date: xx December 2007
Time: 9:30 – 11:00 pm (one and a half hours)
Place: [xxx]

Board of Examiners
Chair: Michael O'Boyle
External Examiner: Robert Irving

Instructions to Candidates

1. Check that the question paper contains 5 pages. If not, inform the invigilator.
2. Attempt **ALL** questions in part 'A' and **ONE** question from part 'B'.
3. The questions vary in difficulty. During your first pass through the paper, you are advised not to dwell on questions to which the answer is not readily apparent.
4. Please write legibly.
5. The marks allocated to each questions are indicated in brackets after each question. Each question is worth 20 marks and the total for the exam is 100.

Part "A"

Answer ALL FOUR questions from this section

1. (a) What are the following and how do they contribute to the process of communication between computers across a network?:
- i. A Cyclic Redundancy Check (otherwise known as a CRC or checksum) [2 marks]
 - ii. A datagram [2 marks]
 - iii. The TCP network protocol layer [3 marks]
- i. A CRC is a number, the result of feeding all bytes of a communications packet through some [polynomial] formula. Errors can be detected by transmitting the CRC with the packet and comparing the computed and received values.
- ii. A datagram is a self-contained data packet which contains enough information to reach a specified destination across a network.
- iii. Datagrams may be lost or arrive out of sequence. The TCP layer is responsible for recovering them and putting them in sequence to create a reliable end-to-end data stream.
- (b) What is a *dongle*? [1 mark]
- It is a key that a PC can read to unlock software.*
- (c) Imagine you are the parent of children aged 10 and 12. What guidelines would you give them to ensure their safety when using the Internet? [3 marks]
- Don't give out personal details to someone you don't know; Do report anything you see that upsets you or you are not sure of; never, ever agree to meet someone you only know on the Internet unless your parent is with you (and preferably is involved in the conversation); Remember not everyone is who they claim to be; etc. etc.*
- (d) What factors would you consider when assessing the reliability of a source of information on the Internet? [3 marks]
- The reputation of the source, who refers to it, whether it names its sources, whether the content is subject to editorial or peer-to-peer review, whether it is visibly independent ...*
- (e) My elderly computer is accessing the hard disk a lot more often than I would expect, especially when I am running several applications at once. What might be happening, what is the condition called and how do I stop it from happening? [3 marks]

Most likely cause is a shortage of RAM resulting in excessive paging or swapping to disk, called thrashing. It is also possible that your disk is significantly fragmented. In the first case add more RAM, in the second defrag the disk. Either answer accepted.

- (f) Which of the following situations are protected by the Consumer Credit Act (1974)?
- i) I order goods via the Internet using my credit card but they are not what I ordered
 - ii) Someone gains access to an account containing my credit card details and uses them to buy goods
 - iii) I pay for goods on eBay via PayPal but they never arrive

[3 marks]

a) and b). c) is not a credit transaction.

2. (a) Describe some of the ways that malicious code such as viruses or Trojan horse programs can reach your computer [2 marks]

Opening email or accessing infected web sites without up-to-date anti-virus software on your PC. Over an open port if you aren't firewalled.

- (b) Describe the major characteristics of a good application. [3 marks]

Fit for purpose, reliable, supportive of the experienced user, tolerant of mistakes, ergonomically friendly, intuitive ...

- (c) A spreadsheet is a member of a class of programs called *decision support systems*. What features of a spreadsheet enable it to support business decisions? [3 marks]

The ability to experiment and ask "what-if?" questions. The ability to present large quantities of information simply and graphically.

- (d) Why might I want to use the following in construction of a Web site?

- i. Cascading Style Sheets
- ii. Java
- iii. Metadata

[6 marks]

- i. *To maintain consistency of style*
- ii. *To provide client-side processing power – everything from animations to local consistency checking of supplied information*
- iii. *To increase the prominence of my site to Web searches*

- (e) i. Compare and contrast the principal features of two common formats for storing images. [3 marks]

*JPG: 24 bit colour, lossy, compact – good for real-world scenes
TIFF: 24 bit colour, lossless, less compact – a good reference format*

GIF: 8 bit colour, lossless, compact – good for diagrams etc.

- ii. What do you understand by the term ‘lossy’ ? [1 mark]

Data is lost in compression. This doesn’t matter so long as the result is ‘good enough’.

- (f) What is *firmware*, where might you find it in a modern computer and what will it do there? [2 marks]

It is software burnt into silicon. It can be found on the motherboard or in smart peripherals where it can help get the system or device up and running and adds intelligence to ‘dumb’ hardware.

3. (a) What do you understand by the term convergence or confluence when applied to computers and communications? Give some examples. [3 marks]

It is the process where the traditional ideas of computers and phones are merged to produce new devices and services such as the PDA/phone, VoIP and smart phones. Other examples might be the set-top box, living room media streamer or networked game station.

- (b) Describe or illustrate the key functions of
i Data mining
ii Geographical Information Systems (GIS) [4 marks]

Data mining: applied to large volumes of data to discover previously unknown trends and patterns, often utilizing AI techniques.

GIS: a specialized database that represents information in a spatial/geographical context, can display data as maps.

- (c) What do you understand by the term fault tolerance? How are programs made fault-tolerant? [3 marks]

It is the ability of a program to keep running reliably while containing errors. Programs are made fault-tolerant by a combination of defensive programming techniques and strict design and quality control

- (d) Approximately how long would it take to download a 1 Megabyte file from
i) a typical modem connected to the phone network.
ii) a typical office Ethernet.
Show your assumptions and working. [4 marks]

Assume 56 Kbit/sec for the modem (7000 kBytes/sec) then 1 Megabyte = $1000000/7000 =$ approximately 140 seconds.

Assume 100 Mbit/sec (12.5Mbytes/sec) then 1 Megabyte = $1/12.5 = 0.08$ seconds. Anything close gets the marks

- (e) Outline some of the major landmarks in the historical development of computers as we see them today. What trends are likely to affect the look and feel of computers over the next few years? [4 marks]

Heavy specialised hard-wired valve-based WW2 machines, transistor-based mainframes, minis, micros, the PC, wired programs -> paper tape and punch card, the VDU, Windows/icons/mice/menus programming, the ARPANet, the Internet. Natural language processing, ubiquitous computers (smart devices), flexible paper-like displays .. anything that shows some historical perspective will get the marks.

- (f) What is Moore's Law? Is it still true? [2 marks]

It is generally taken to be the rule that says that anything to do with computers (speed, capacity etc.) doubles every two years or so. It still applies to most aspects of computing though processor development is hitting the limits of single-processor performance without major new technologies

4. (a) What are the advantages and disadvantages of communicating via text (e.g. paper letter, SMS text, Instant Messaging or email) versus a phone or video call? [3 marks]

Advantages: convenient, most forms don't need the person the far end to be present, can make a permanent record, can forward it etc. Disadvantages are that it is difficult to communicate shades of meaning such as expression and body language, it is slower (much slower for a letter) and without security checks one can forge an identity.

- (b) Why is the IP address "129.317.25.5" invalid? How many IP addresses is it possible to have? You may express this figure as a product of numbers. [2 marks]

*Because each IP quartet is one byte long i.e. has a max value of 255. There are $256*256*256*256$ possible IP addresses.*

- (c) A very simple automaton to manage a communications interface can be described as follows:
1. Wait for a clock tick.
 2. When the clock ticks, check to see if a packet is waiting to be sent.
 3. If no packet is waiting, wait for the next clock tick.
 4. If a packet is waiting, send it and wait for a response.
 5. If the response is positive, go and wait for the next clock tick.
 6. If the response is negative, resend the packet and wait for a response.
- Draw a state transition diagram that describes this automaton. [4 marks]

2 nodes: A: "wait for tick" and B: "wait for response".

From the above list, edges are:

- 3 A -> A
- 4 A (send packet) and -> B
- 5 B -> A
- 6 B (resend packet) and -> B

There is an alternative version with 3 nodes – timer takes automaton to another state where the edges are "packet waiting" or "no packet waiting". Anything that demonstrates the concept of an automaton and programmed behaviour will get the marks.

Will this automaton cope with all possible eventualities? If not, describe one problem and explain how you could amend the automaton to fix it. [2 marks]

No. It will sit indefinitely at node 'B' if the far end never responds. One could timeout then resend the packet anyway or timeout and drop the line.

- (d) The human eye and brain have particular strengths and weaknesses when it comes to assimilating information. Explain how computer software writers take this into account when designing medical imaging software. [4 marks]

The points required here are that the human brain is excellent at spotting patterns in visual data but not so good at visualising concepts in 3D without help and can be overwhelmed with clutter. Medical imaging systems combine huge amounts of information from multiple slices through the body into 3D rendered images which can be rotated, zoomed or sliced and where unwanted detail can be removed.

- (e) The cost of air travel has gone down in real terms by about a factor of 10 in the last 30 years. What contribution do you think computers have made to this process? [5 marks]

Design of aircraft engines, design and simulated testing of airframes and aerodynamic surfaces, optimising of routes, fare structures and schedules, accurate marketing ...

Part "B"

Answer ONE question only from this section

- B1.** In the computer-enabled world what do you understand by the term 'Intellectual Property'? In what forms is it encountered, who owns it, how is it infringed and what protection exists under the law for its rightful owners? [20 marks]

One full lecture refers. An opportunity to discuss copyright, patents, trademarks, domain names, downloading, piracy, golden handcuffs, ...

- B2.** Computers are invariably agents of change. Explain what issues have to be considered to ensure that a major change in IT systems in a big office goes smoothly both from an organisational and from a human point of view. Use as an example the merger of two companies with incompatible office IT systems. [20 marks]

Again, one full lecture refers. Points expected include the need for planning, testing, contingency measures, the need for fall-back routes. Human issues include peoples' reaction to change including feeling threatened and the need to get them on board. Training has to be considered and timed correctly.

- B3.** The UK Government is considering introducing a national ID card within the next few years. IT will clearly be a key factor in making the scheme work. Discuss the likely benefits and dangers of an IT-based ID card and some of the technical, ethical and legal problems and issues likely to be encountered as the card is introduced. [20 marks]

Benefits – one card, one-stop access to facilities and information, clear unforgeable statement of ID. Drawbacks - power of government over the individual, weapon in the wrong hands, identity theft. Problems – huge projects like this always go way over budget and time. Huge databases, networks; interaction with other systems. Security has to be tight; the system has to be proof against attack by viruses, Trojans, denial-of-service, everything. How do you test it? Ethical issues – who gets to know what? Who gets to alter information? What legal framework will be required? How does the ID card fit into existing framework – ECHR, RIP , Data Protection etc. ? What about people who won't or can't use it? If there is mass rejection will it still be workable?

- B4.** In the course you were presented with some ideas from current research in Informatics and invited to read around a topic that interested you. What do you understand about the current situation in the topic of your choice, where is it going and what benefits (or dangers) is it likely to bring to business or society? [20 marks]

They will have notice that a question like this will be in the paper. Well read and articulated answers will get the marks.