

UNIVERSITY OF EDINBURGH

COLLEGE OF SCIENCE AND ENGINEERING

Computer Literacy 1h

Class Examination
[with sample answers]

Date: 25 January 2003

Time: 09:30 a.m. – 11:00 a.m.

Place: Appleton Tower Concourse

Board of Examiners

Chair: M.R. Jerrum

External Examiner: R. Dyckhoff

Instructions to Candidates

Attempt **ALL** questions in part ‘A’ and **ONE** question from part ‘B’

Marks for questions are indicated in brackets after each question and the total for the exam is 70.

Candidates in the third or later year of study for the degrees of MA(General), BA(Relig Stud), BD, BCom, BSc(Social Science), BSc(Science) and BEng should put a tick (✓) in the box on the front cover of the script book.

Part "A"

Answer ALL questions from this section

1. (a) What is e-mail 'flaming' and how can it be prevented ? [2 marks]
[It is the exchange of intemperate remarks between several members of an e-mail conversation, usually characterised by an ill-judged remark provoking multiple rebuttals and a descent into taking sides. It can be prevented by considering what one says, applying netiquette, avoiding knee-jerk reactions and making use of 'smileys' etc. to clarify the intention of otherwise featureless text.]
- (b) What is Moore's law? Name one 'brick wall' that might prevent computer performance from following Moore's law indefinitely. [2 marks]
[Taking the very general version of Gordon Moore's original law says that every quantitative measure to do with computers doubles every couple of years. Two brick walls are 1. 'running out of atoms' (feature sizes becoming so small that quantum effects drown everything in noise though I don't expect them to say this) and 2. heat dissipation. 3. decreasing size of systems [rd]
- (c) What are the advantages and disadvantages of backing up data to tape versus CD-writer for:
i. 300Mb of personal files ?
ii. The contents of an entire modern hard disk ? [2 marks]
*[i. CD-RW: pro: speed, permanence, cheap; con: can't re-use media (maybe). Tape systems: expensive, need to locate file sequentially on tape
ii. CD-RW: con: would need 100 to back up a 65 Gb disk*
- (d) Windows filing systems delete files by returning the blocks to a free list and removing the file name entry from a table of contents. What does *not* happen and what is a consequence of this? [2 marks]
[The actual data is not deleted and can be recovered using special software. This has to be borne in mind when disposing of a PC (or doing anything criminal or subversive on it!)]
- (e) GIF, TIFF and JPG are all image file formats. Describe a significant difference between any two of them and say how this affects the way they are used. [2 marks]
[GIF: lossless, 256 colours max, useful for diagrams, buttons, graphics. TIFF: lossless, no significant colour limit, useful 'reference' format. Browsers generally don't handle it. JPG: highly compressed, lossy, good for pictures of real-world scenes. 'Loss' shows up as soft edges to lines which is why GIF is better for diagrams. I'll accept anything that shows they have some idea of what's going on.]

2. (a) Describe or illustrate the key functions of

i. A Spreadsheet application

ii. A Linear Programming package

iii. A Database Management System (DBMS)

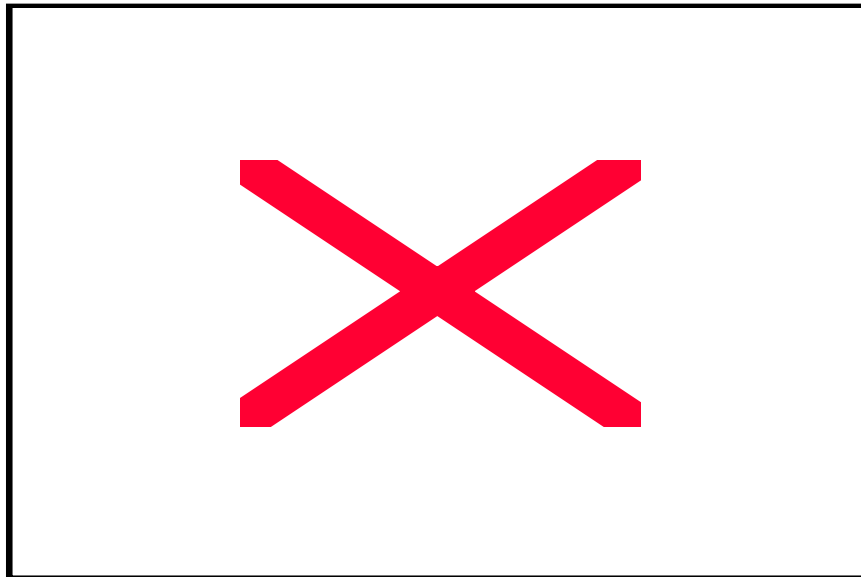
iv. A Geographical Information System (GIS). [4 marks]

[Spreadsheet: Software 'Swiss-army knife' but principally visualisation, experimentation and answering 'what-if' questions. LP package: Optimisation of multiple variables (e.g. airline schedules); Database: storage and retrieval of information in a consistent and flexible manner; GIS: A Database that is aware of spatial relationships (e.g. route planner). Any description or example that shows understanding of what the applications are used for gets the mark]

(b) i. Give two advantages of displaying information in graphical as opposed to numeric form. [2 marks]

[Easier to assimilate large quantities of data in graphical form; Easier to illustrate abstract or complex concepts; Easier to spot patterns; Easier to visualise 3D information ...]

ii. Outline some of the processes involved in producing a simulated real-world scene such as the one illustrated. [4 marks]



[Creating a mathematical model of the scene, defining a viewpoint and adding perspective, representing scene as a mesh of polygons, hidden-line deletion, smooth shading, shininess and surface properties, colouring, lighting, texture mapping, shadows, reflections ...]

3. (a) Describe some of the features you would expect to find in a well-designed software application. Illustrate your answer with examples from software you have used in the course. [5 marks]

[Matched to the purpose, intuitive to novice user, self-tutoring, unobtrusively supportive of advanced user, reliable, tolerant of experimentation, pleasant to work with/good ergonomics ... Examples would include: extensive help and tutorials, intuitive 'metaphors', consistent location of key functions, meaningful icons, confirmation-before-delete, 'undo' feature, tool-tips, document recovery after crashes ...]

- (b) There were reputedly over 3000 bugs in Windows 95 yet aircraft control systems are just as complex and are expected to operate with failure rates of less than 1 in 1,000,000,000 hours flying time.

- i. How do you explain this apparent discrepancy? [1 mark]

[anything containing the expression 'fault-tolerant' gets the mark]

- ii. What features of software design and implementation are needed to ensure a high level of software reliability? [4 marks]

[Lecture 20 refers: design: requirements – doing the right thing/validation; specification – doing it the right way/verification; implementation – doing that correctly/testing. Implementation: everything performs sanity checks on input and output; fail in predictable manner if you have to; last-resort 'back-stops'; Certified design and test procedures, smart simulation; formal proofs of correctness; also cognitive aspects to reduce number and consequence of errors]

4. (a) Give two similarities and two differences between e-mail and conventional postal communication. [2 marks]

[similarities: addressing; staged delivery process (packet-switched). Differences: speed, packaging, 'manipulation' – e-mail may be dismantled, MIME-encoded, re-assembled etc.]

- (b) Explain how reliable communication can take place over unreliable links. [2 marks]

[Anything showing understanding of link level functions: error detection/recovery, (flow control) and packet numbering and retransmission. Sender must keep track of message sent; message only reported as delivered when receiver acknowledges correct receipt. Some may have to be sent repeatedly until a copy is correctly received]

- (c) Outline the differences between two wired physical media used for computer-computer communication. [2 marks]

[anything on: speed, cost, medium, distance, etc. acceptable]

- (d) In the context of wireless telephony distinguish between 1G, 2G, 2.5G and 3G by listing one characteristic of each. [2 marks]

[1G: Analogue cellular phone; 2G digital; 2.5G: wireless internet access to PC/PDA; 3G: 'always-on' broadband wireless internet access]

- (e) Illustrate insertion sort on the following series of letters. Show the set after each change with the final sorted list having letters in alphabetic order from left to right. [2 marks]

A Z F D L B
[A F Z D L B
A D F Z L B
A D F L Z B
A B D F L Z]

5. (a) For each of the following, draw out and describe a suitable network topology and the relationship between clients and services:

- i. Intelligent lottery terminals and their central server
- ii. Student PCs within a university microlab
- iii. The Napster music-exchange facility
- iv. Point-of-sale terminals within a large supermarket.

[4 marks]

[i. star network (WAN) with lottery terminals a fairly dumb clients of some central server; ii. Bus network (LAN) with lab machines receiving file, print and mail services from central servers; iii. WAN again but this time peer-peer; iv. As ii – clients on a LAN interacting with a local server]

- (b) Explain the function of **two** of:

repeater; bridge; gateway; router.

[2 marks]

[repeater: boost electrical signal; bridge: connect two similar LANs; gateway: connect two similar networks; router: select networks from point reached to final destination (by s/w)]

- (c) What is a *mesh* network?

[2 marks]

[Mobile wireless. Every device acts as repeater and router as well as sender and receiver. Devices within range of each other create network dynamically]

- (d) A corporation is wiring up networked services within its sites and between sites nationally. Within the sites it can operate privately-owned networks. Give two ways it can join these together to form an *Extranet*. [2 marks]

[Leased lines

Built-on open Internet but using encryption s/w to create virtual private network]

Part "B"

Answer ONE question only from this section

- B1.** The purpose of a Web site is to support the objectives of the individual or organisation to which it belongs. Using examples where appropriate describe some of the likely objectives of businesses or institutions and the ways in which Web sites can support these. [20 marks]

[Objectives: making money – direct sales (convenient purchase at the site, e.g. amazon.com), advertising (Irn-Bru), brand maintenance and promotion (Coca-Cola), marketing in the widest sense (many sites establish a relationship with customer – everyone from rock bands to software companies), information (airline route planning, consumer electronics specifications), after-sales and product support (software downloads, updates, service and technical information). Institutions such as Universities exist to disseminate information or make it available between colleagues (where it all started). Sites provide feedback to the owner. And so on.]

- B2.** IT is used in business, government, education, health and many other aspects of everyday life. This brings benefits if used wisely but dangers if abused by individuals or repressive governments or exploited by terrorist organisations. Discuss some of the ways in which IT materially affects our lives for the better and the issues we all have to be aware of to prevent its abuse and maintain our safety, privacy and freedom. [20 marks]

[Source material from lectures plus some newspaper articles they were given to read. Probably the core of this is the security of information – benefits come from linking information from numerous sources and it being 'ubiquitous', e.g. patient records that follow the patient. Dangers come from exactly the same source. Then there are the benefits of customer records (convenient, personalised service) but dangers (intrusive marketing, loss of privacy from companies accumulating information about customer behaviour). Databases are being accumulated to pin down terrorist activity but terrorists can gain access to records and subvert them or mount denial-of-service attacks. There was an essay assignment in a related area – this question takes a wider view]

- B3.** Describe the services and technologies involved in allowing me to send e-mail reliably and securely from my WiFi-enabled PDA at the bottom of my garden to my daughter at home in Singapore or at her satellite station in the Sahara. [20 marks]

[There are many ways into this question – essays could concentrate on network technologies (Wireless -> broadband -> Internet -> back to broadband or out to a satellite service provider (essentially invisible above IP), services such as e-mail accessed by the web or whatever, reliability, security, 'layering' of services over carrier networks, the list goes on. Anything explaining how these fit together is acceptable]

- B4.** The School of Informatics lost a building and a quarter of its computing resources in a catastrophic fire in December 2002. Describe what you would expect to have been the consequences in terms of IT. If you were faced with this situation what problems would you expect to have to deal with in what order to get everyone up and running again? What opportunities might exist to exploit new technology to rebuild the complete IT infrastructure of a university department from nothing ? [20 marks]

[An invitation to talk about how IT is used in a department and to prioritise the services provided. Loss will have included all desktop machines (need to be repurchased and configured though machines will end up a higher spec.), software (licenses will need to be repurchased or renegotiated), user files (recover from backup). Recovery priorities will be: Access to intact facilities so people can read mail; rebuilding of servers, restoring of user accounts and files; fast creation of a lab so people can begin to work again; rewiring replacement offices (wireless LANs can help here). All rewiring will use latest technology (fast). There are many points that could be made and probably the easiest way into the question is for them to think about the services they use from day to day then prioritise them]