UNIVERSITY OF EDINBURGH

COLLEGE OF SCIENCE AND ENGINEERING

Computer Literacy 1h

Degree Examination
Specimen Solutions
(figures in brackets are [lecture, slide])

Date: Friday, 28 May 2004
Time: 14:30 – 16:00 (one and a half hours)
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. Each question in part 'A' is worth
ELEVEN marks and the total for the exam is 75.

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) i. What are the principal differences between the *raster* and *vector* representations of a graphical object? [2 marks]

Raster representation: grids of pixels; fixed size (doesn't scale especially for fonts - gets blocky if you try). Vector representation – a description of how to build the object in terms of lengths of lines, radii of curves etc. Will scale. [7.6, 7.7]

ii. What is *antialiasing* ? [1 mark]

The blending of foreground and background colours at the edge of a graphic object (usually a character) to produce a smoother appearance. [7.8]

(b) What do you understand by the term
    i. Mainframe? [1 mark]
    ii. Server? [1 mark]

i.   Mainframe: Large central corporate machine – typically runs fixed pattern of work, e.g. payroll, accounts, nightly reconciliation of trading positions. Centralised, multi-function, company-critical. [5.2]

ii.   Server: distributed, networked, may be one of many. Single-function e.g. mail, web, printing, server of client-server cluster. May be middle ground between mainframe and clients. [5.3]

(c) The Apple iPod portable music player contains an 80Gb hard disk. Roughly how many 3 minute MP3 tracks would I expect to be able to store on it? Show your working and assumptions. [2 marks]

2-4 Mb per MP3 track into 80 Gb (80,000 Mb) = 20,000 – 40,000 tracks.

(d) What is being described in the HTML statement
    <body bgcolor="#FF8080"> ? [2 marks]

It introduces the body section of a Web page and sets the background colour to 0xFF (255) units of Red and 0x80 (128) units each of Green and Blue (i.e. a pale red). [24.15]

(e) Why is it normally inadvisable to halt a PC by switching the power off at the wall? [2 marks]

The PC disk filing system may be in an inconsistent state (specifically there may be unwritten-back cache items) [4.11]

2. (a) In what ways has the Internet affected business processes and products? Give examples where appropriate. [4 marks]

New communication and distribution channels, new types of product and service (software, MP3 and ringtone downloads; trading hubs), new concepts of value (e.g. information), new types of relationship (Just-in-time), new kinds of information, greater pace, globalisation, integration (call centres + back office). [33.4, 33.6]

(b) Describe some causes of *failure* in computer systems. What do we mean by software failures and how can these be avoided? [4 marks]

A failure is when a fault is encountered and not properly handled. Solution is fault-tolerant programming together with well-understood design and exhaustive testing and documentation procedures.
The classic 'comma instead of full-stop' implementation error. Suitable programming languages; Testing.
The Ariane error – evolutionary failure in requirement or specification 'right software in the wrong rocket'
Human interaction – USS Yorktown under test didn't handle a wrong data entry properly.
Human Communication – Mars probe, half in metric half in imperial.
Most failures have multiple causes [27.6-27]

(c) i. What are the principal functions of a Database Management System (DBMS) ? [2 marks]

Handles authorisation, allows multiple simultaneous users, builds and executes queries, generates reports, handles data input and validation, can force data integrity, etc. [11.7, 11.8]

ii. Give an example of a question that might be answered by a Geographical Information System (GIS) ? [1 mark]

"What is the value of property in flood plains in Lothian?" "What is the proportion of dwellings with multiple deprivation in Falkirk?" etc. etc. Anything which requires a spatially-aware database to answer. [11.23]

3. **(a)** Describe some functions of an *operating system* [4 marks]

Task scheduling; managing hardware in a consistent manner; inter-process communication and protection; resource management (e.g. virtual memory; startup and shutdown; configuration; file system; GUI. [13.13-22]

(b) Describe some of the benefits and problems likely to be encountered in using the various forms of groupware (videoconferencing, chat etc.) as opposed to real-world meetings. [4 marks]

Advantages: Desktop or studio video allows otherwise inconvenient or expensive meetings. Netcasts ditto and allow dissemination to a wide group. Disadvantages – no eye contact, poor sound, loss of body language, difficulty in reproducing tacit cues present in real-world meetings, anonymity, lack of relationship cues (flaming the boss) etc. etc. [25 1-17]

(c) Compare and contrast what is meant by the terms RAM, CD-ROM and Hard Disk [3 marks]

RAM = very fast semiconductor memory used for temporary storage. Read/Write; Volatile. [4.8]

CD-ROM = essentially permanent storage on rotating disk but read-only as far as normal use is concerned. Much slower than RAM and slower than hard disk. [4.14]

Hard Disk = moderately fast read/write storage on rotating media, non-volatile, used for storing files. [4.15]

4. (a) How do computers contribute to the spread of identity theft?   [2 marks]

If a person is considered to be 'defined' by information held about them on computers then a predator who has access to such computers can acquire and use this information to pretend to be this person. With many transactions and communications conducted electronically predators can mimic messages that may appear genuine and trick unsuspecting computer users into divulging personal details.

(b) How does a computer become infected with a virus?   [2 marks]

Any valid explanation involving infected portable media, e-mail attachments or downloads from websites will be accepted.

(c) What steps can be taken to avoid computer virus infection?   [2 marks]

Keeping operating system patches up-to-date, running anti-virus software. Exercising common sense. Also firewalls limit the ability of Trojans to 'phone home'

(d) Explain why encryption is necessary in computer communication? [2 marks]

Communication channels both wired and wireless can be eavesdropped. The solution is to protect the message and/or the channel i.e. encrypt messages so that only intended recipients have easy access via decryption or use secure sockets.

(e) How do protocols and standards contribute to the expansion of communication?   [3 marks]

Standards whether developed and imposed by organisations or accepted after growing use define a context in which software and hardware can be developed, manufactured and deployed with economies of scale. Protocols allow efficient communication in different contexts and environments so any prospective user can join in by employing the right protocol(s) and adhering to standards for all relevant aspects of connection.

5. (a) Study of sorting algorithms and the Tower of Hanoi problem illustrates the importance of finding a good algorithm and understanding complexity and scaling. Explain how these considerations arise in the following.
  i.   Detection of plagiarism
  ii. Bank and airport security
  iii. Secure message transfer?   [4 marks]

  i.   *Plagiarism detection involves searching for matching text. Success and speed can depend on the size and organisation of the database to be searched, how a comparison is made and techniques to direct the search. The problem is simple to state and easily visualised for a small example but*

even with high-speed computers harder to see how the WWW can be efficiently searched.

ii. *Security systems dependent on matching data such as fingerprints, irises are much less well-defined. A very good algorithm may still not be good enough and produce false matches as well as missing matches that should be detected.*

iii. *Encryption and decryption involve looking for algorithms that allow swift transformations for the users but make cracking the code computationally infeasible for the malicious snooper.*

(b) Why should we be worried about our details being recorded in computer databases? [3 marks]

Any valid points acceptable particularly relating to erroneous records, transfer of records to other databases or agencies and communication links allowing confidential information to be accessed and matched with unrelated records. Tracking via swipe cards, credit cards, networked computer use, mobile phone use, RFID tags (soon) etc.

(c) Give two examples of why parents should be concerned about the influence of computers and the Internet on their children. [2 marks]

Pornography; undesirable contacts via chatrooms; social influences; information overload; variable quality of information; privacy.

(d) What is the Communications and Multimedia Act? [2 marks]

An act in Malaysia that defines rules for interception of communications and searches of computers supposedly to protect individuals and control potential abuse by police and other agencies.

Part "B"

Answer ONE question only from this section

B1. 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]

Lecture 36 refers. 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?

B2. Consider your typical morning from waking up till you reach the University. Describe how you think Information Technology has shaped or maintains the products and services you would encounter in the first couple of hours of a normal day. [20 marks]

Alarm clock and many other household products – designed by CAD systems and may contain intelligence. Listen to the radio or stored music – media prepared using IT, created on computer, news programmes fed by networks. Electricity and phones rely on networks to maintain them as does the postal service. Transport systems may be maintained from networked control centres. Vehicles on the street contain much IT. If you stop to buy anything the shop will subscribe to a computerised delivery network. Advertising and marketing of products and services are all heavily dependent on computer analyses. Just about anything you touch or do relies on computers to a degree. The trick in this question is realising how.

B3. **(a)** Describe some key elements of each of the three following networks that allow two users to communicate. You may use diagrams.
  i. The Internet
  ii. The fixed telephone network
  iii. A mobile phone network

[10 marks]

An acceptable answer should in each case identify nodes and links. Keywords: direct link, LAN, ISP, backbone network, telephone line, exchange, network of exchanges, wireless communication with transmit/receive tower, cell, switch. Could also talk about protocols.

(b) Outline how the digital revolution means that these networks are now overlapping and linked in providing services. [10 marks]

Elaboration of following would suffice. Internet access using fixed telephone lines. Internet services delivered to mobile phones (1G, 2G, 2.5G, 3G). Voice communication using Internet.

B4. **(a)** Computing in the home may now involve many computers and many different functions and services. Briefly describe what can be provided and how it is provided. [10 marks]

Standalone processing, storage, printing, digital photography.
Internet access for banking, shopping, music, video, gaming, office work.
Networking. Controls. Bluetooth, WiFi, cable, ADSL.,

(b) Outside the home mobile computing continues to grow. Explain what this means in terms of standalone and networking capability and how it is provided.
[10 marks]

Mobile devices – phones, PDAs, laptops
Access points – rural and urban. Coffee shops, bookshops, hotels, airports, street furniture, houses.
Wireless nodes, satellite, WiFi, mesh.