UNIVERSITY OF EDINBURGH

COLLEGE OF SCIENCE AND ENGINEERING

SCHOOL OF INFORMATICS

Computer Literacy 1

Degree Examination

Solutions

Date: ? December 2005
Time: ? (one and a half hours)
Place: ?

Board of Examiners
Chair: M.R. Jerrum
External Examiner: Robert Irving

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 is worth 20 marks and
the total for the exam is 100.

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 cross (✕) in the box on the front
cover of the script book.

Part "A"

Answer ALL questions from this section

1. **(a)** Explain three of the key stages and developments that have led to modern Computing & Information Technology. [3 marks]

Wartime hand-built machines -> scientific machines, business mainframes -> PC; Hard-wired -> paper tape/card -> VDU -> mouse/icons/windows

   (b) Where might you find *caches* and what do they do? [3 marks]

They are fast stores of material that has been fetched from a slow medium and may be required again. The cache is checked on every [read] access and where possible the cache copy is used instead of having to refetch the data from the slow medium. They can be found as adjuncts to processors (where memory is slow), hard disks (disk rotation is slow) and Web caches, both server-side (server disk is slow), network and client (browser)-side (network is slow).

   (c) Describe the factors you would consider when choosing a laptop computer. [3 marks]

Operating system (Mac vs Windows) power, weight, screen size and resolution, hard disk size, battery life, reputation of company, convenience of dealer, software bundle

   (d) In what ways does the *file system* support use of a computer? [2 marks]

Managing allocation of disk space, allowing creation of volumes and partitions, creation, reading and writing, copying, renaming, protection and deletion of files. Comments about ancillary functions such as (de)fragmentation and formatting will also be accepted.

   (e) Explain two of the ways in which computer graphics can aid understanding. [4 marks]

Principally presentation of large volumes of data in an assimilable form. Graphics also allow visualisation of complex processes especially in 3D.

   (f) Describe three problems that have to be overcome before two computers can exchange data over a point-to-point link. [3 marks]

A protocol has to be agreed. Bits have to be encoded on the line (modulation) then bundled into packets with some form of error detection and correction. Flow control has to be managed and possibly data compression.

   (g) Give an example of
     i. a bus network
     ii. a tree network. [2 marks]

Ethernet
USB
Any valid answer accepted e.g. motherboard system bus

2 (a) What is VoIP ? [2 marks]

Voice over IP. It is the process of using a suitable adaptor to take voice from a phone or microphone then send it over the Internet. The adaptor could be a dedicated box or a PC. Calls between VoIP phones are essentially free though charges will be levied for calls via the phone entwork.

(b) My home network supports several wired PCs plus a laptop with WiFi. From my laptop at home I can double-click on an icon representing a file within Informatics and load it into Word. Identify as many hardware and software components as you can that exist between Word on my home PC and the file in Informatics. Choose two network components and explain what they do. [6 marks]

Several layers of operating system in my PC; my personal firewall; my WiFi network card; my WiFi Access Point; my router; numerous Internet switches and routers; the University firewall, switches, routers etc.; the file server; file server operating system;

(c) What is a 'beta release' ? [1 mark]

A release of software that is in its final stages of bug fixing but which is close enough to the final release to be offered to selected users. The user gets software in advance of others and the the software manuifacturer gets feedback.

(d) What do you understand by the term "phishing"? How is it done? [2 marks]

It is the process of attempting to obtain identity information by deception. An example would be falsifying mail as from a bank requesting account details. There are many phishing tricks but one would be to mail out to many recipients requesting details as above, taking care to make the mail look genuine. The mail contains a link to the URL of facsimile of a genuine site but with false account dialogue boxes. The true URL will be concealed in some way.

(e) As well as content, designers of a successful Web site need to consider its *Function, Style* and *Structure*. Choose any one of these and explain how doing it well or badly will affect a web site. [4 marks]

Function: *site has to further business or personal aims of its owner. Failure to do so will result in it being a waste of time or opportunity and possibly even act against the company if it is seen to be a poor performer.*
Style: *Site has to be attractive, modern, easy to read and easy (behind the scenes) to update, e.g. by use of style sheets.*
Structure: *Site has to be easy to navigate with no irritating dead ends. It needs to load quickly and reward the visitor for their patience.*

These are just samples from at least one lecture. Any valid arguments accepted

(f)
    i   What barriers prevent people from feeling confident in shopping over the Internet? [3 marks]

Trust, security, lack of business and legal models, culture, lack of qualified personnel, speed/availability of broadband

    ii   Give an example of one legal and one technical mechanism that protects on-line customers. [2 marks]

Legal: Consumer Credit Act 1974. Technical https: secure connections.

3 (a)   What is a Motherboard, and what does it contain? [4 marks]

A motherboard is the main circuit board inside the cabinet of a PC. It contains the CPU and the circuitry joining everything together, principally via the Bus. Also has interfaces and connectors to floppy disk, hard disk, keyboard, etc.

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

Data mining*: applied to large volumes of data to discover previously unknown trends and patterns.*
GIS*: a specialized database that represents information in a patial/geographical context, can display data as maps.*
2 marks for each.

(c)   What are Classified Directories, and what are they good for? How are they related to Subject Gateways? [3 marks]

Classified directories are manually compiled directories of web pages, organized into subjects. Good for browsing a subject area and for general information queries. Subject gateways are classified directories that focus on specific subjects, usually designed to meet the needs of HE.

(d)   What is a bit? What is a byte? How many different possibilities can a byte express? [3 marks]

A bit is one unit of 'information' in some binary scheme, e.g. 0 or 1, so each bit has one of two values. A byte is eight bits and can therefore express $2^8 = 256$ different possibilities.

(e) Name some active research topics in Natural Language Processing and explain why they are important. [3 marks]

Topics: Segmenting phonemes, translation methods, handling of idiom and pronunciation effects
Results: Easier and more natural/intuitive interaction with computers, especially PDAs etc. where keyboards are not an option or produce RSI and for disabled users; voice portals; translation; understanding of our own speech.
Any valid examples from this part of the course accepted.

(f) What factors limit the experience of desktop videoconferencing as opposed to a real-world conversation? [3 marks]

Breakup of sound, jerkiness and low resolution of image, impossibility of looking both at screen and into camera, inadequate transmission of body language

4 (a) Name and describe the 3 levels of the 'layers of abstraction architecture' used by most DBMSs. [4 marks]

__Physical__ layer – contains the physical data files, often spread over multiple disk drives
__Logical__ layer – abstract data structures, which don't have a concrete physical existence. Depending on particular DBMS can be a set of 2-D tables, a hierarchical structure, network model, etc.
__External__ – layer of abstraction above the logical layer, where users and applications issue queries against the database and obtain user views.

(b) What is 'physical data independence'? Give an example. [3 marks]

Physical data independence is the ability to alter the physical file structure without disrupting exiting users and processes. E.g. a spreadsheet application on a PC when copied from hard disk to floppy – different physical medium but the data will be presented to the user in exactly the same way.

(c) Describe a primary difference between Turing Machines (TMs) and von Neumann architecture. [3 marks]

Most crucial difference is register memory – numbered storage locations that can be accessed directly rather than by crawling along the tape.

(d) What is the Church-Turing Thesis, and what does it tell us about the computational power of a Universal Turing Machine (UTM)? [4 marks]

The Church-Turing Thesis states that any function computable in an alternative framework for capturing the notion of an effective procedure can be computed by some TM. A UTM is programmable in the sense of being able to imitate any other TM, so it can compute anything that any other TM can compute. So the Church-

Turing thesis indicates that a UTM can compute anything that's in principle computable.

(e) What is syntax, and what is semantics? Provide an example of each type. Which is processed by a computer, and why? [4 marks]

They are the 2 primary levels of language. Syntax is the level of sign, symbol or notation. Semantics is the level of meaning or reference – what the symbols are about. So the English word 'tree' is an example of syntax, whereas the botanical organisms themselves are the semantics. Computers can only process syntax or symbols, e.g. can manipulate the string 'tree' (or 'baum'), but a tree itself isn't stored in any register. Any reasonable answer demonstrating understanding of syntax v. semantics accepted.

(f) What do you understand by the term 'defensive programming'? [2 marks]

It is programming where each component of a system mistrusts all other components and performs sanity checks on information it sends or receives then fails in a controlled manner if errors are seen. It is used as part of a process of making software fault-tolerant.

Part "B"

Answer ONE question only from this section

B1. "It's a jungle out there". This statement could very well describe the Internet. Describe the personal and technical issues one needs to be aware of before attaching a computer to the Internet and using Internet services and why.

[20 marks]

An invitation to talk about any form of malicious network-based activity. Anything from viruses and Trojans through use of antivirus software, firewalls, phishing, predation, spam ...

B2. The IT Society is a double-edged sword. Discuss how the law, the markets, the nature of computers, networks and norms of behaviour combine to create opportunities and threats to our way of life, and how these can be kept in balance. [20 marks]

Last several lectures about this topic. Some benefits: access to information, people (communication), flexibility in work patterns, new forms of experience/entertainment, new products and markets, business efficiency (reduced costs, more choice), breakdown of borders. Some problems: use of info to control people, pace of life, info overload, computer crime, invasion of privacy. Balance: laws on hacking, stalking, etc., data protection. Norms: people usually conform to acceptable behavior (but internet anonymity can erode this). Nature: real world has geography (spatial separation) while internet doesn't. In the real world the red light district is across town, on the internet it's on your monitor. Free speech vs censorship.

B3. Between the worlds of e-science, e-business and ordinary life there are many 'models' of how computers can be used together. These include Grid computing, pervasive computing, distributed computing, client-server working, middleware, peer-to-peer working, wired and wireless communication and so on. Compare and contrast some of these technologies using what you know of IT, illustrating your answer with suitable examples. [20 marks]

This is an invitation to talk about any of the topics mentioned. All were covered to a significant degree in lectures and any points that demonstrate an understanding of how computers are applied

B4. Is Artificial Intelligence (AI) a realistic possibility? Distinguish between 'weak' and 'strong' AI, and discuss the feasibility or otherwise of the latter. In your answer consider the major achievements of AI so far and the major obstacles in its path.

[20 marks]

'Weak' AI is the view that computers can be useful tools for simulating or modelling human intelligence (just like they can model the weather), whereas 'strong' AI is the view that there is an essential tie between computation and cognition, and hence that computers themselves can become genuinely intelligent and sustain actual mental states just like humans, i.e. computers can be minds. AI research has resulted in a number of valuable applications, e.g. planning, NLP, speech recognition, robotics, vision, expert systems, etc., but these all fall far short of the type of autonomous agency and real world robustness that characterize natural intelligence. One of the biggest problems for AI systems is general 'world knowledge', which allows for common sense understanding not captured by a massive database. Well reasoned answers in either direction accepted