

UNIVERSITY OF EDINBURGH
COLLEGE OF SCIENCE AND ENGINEERING
SCHOOL OF INFORMATICS

Computer Literacy 1

Degree Examination

Solutions

Date: 25 August 2006

Time: 2:30 – 4:00 pm (one and a half hours)

Place: David Hume Tower, Faculty Room South

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) i. What is the function of a *cookie*? [2 marks]
ii. How can cookies affect your privacy? [1 mark]

[netwk1(15) handout] A cookie is a packet of information sent to a browser from a server, when the user has visited a Web site on the server. The browser then sends the cookie back each time it visits the server again. Cookies are useful because they allow Web sites to keep track of their users. This can allow the website to

- Remember your login name and password for the site
- Remember personal details you may have entered
- Maintain a "shopping basket" on a commercial site
- Keep track of your use of the website

Cookies can last for just one session (e.g. for a shopping basket) or stay on the computer indefinitely. They can be time saving and helpful for the user. However, they can potentially present security issues. For instance, other sites may identify which Web sites you have visited by reading your cookies.

- (b) i. What is the difference between a program that is *fault free* and one that is *fault tolerant*? How are programs made *fault tolerant*? [2 marks]
ii. Give an example of where you might expect to find a *fault tolerant* program. [1 mark]

A fault free program has no errors in it. In practice this is essentially impossible to achieve so fault tolerance is achieved instead whereby errors are handled in a controlled manner. The simplest example is defensive programming where no one piece of code trusts any other and makes sanity checks on material sent and received. Highly structured, formal and closely monitored design and implementation regimes also have a role to play.

Examples: Nuclear reactor control; aero engine management program – anything safety-critical really.

- (c) What are the following and what features would you expect to find in a mobile phone that could make use of them?
i. GPS [2 marks]
ii. GPRS [2 marks]

GPS is a Global Positioning System. A phone with GPS will know where it is at all times and can inform its carrier of the presence of nearby objects such as shops, petrol stations etc. GPRS is the General Packet Radio System. A GPRS or 2.5G phone will have access to a variety of network data services such as WAP (Web) and possibly email.

- (d) What are the functions of a *scheduler*? [2 marks]

[os(7) handout] **Scheduling** is the process of ensuring that multiple tasks can run and share one set of resources

- Each program gets a 'fair' share
- One program can't lock out another
- Priority activities get through
- Individual program performance is optimised
- Overall performance is optimized

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

[graphics(14) handout] Enlarge on any two of:

- It can make documents such as presentations or webpages fun and eye-catching
- It can help guide attention
- It can help illustrate a temporal process
- It can help illustrate a sequence of ideas

(f) What are the functions of:

i. HTML	[1 mark]
ii. a URL	[1 mark]
iii. XML	[1 mark]
iv. HTTP ?	[1 mark]

- i. HTML – scripting language for writing web pages
- ii. URL - address of an item somewhere on the Web
- iii. XML – framework for creating objects containing meaning
- iv. HTTP – protocol for communicating between Web entities

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

Information about information –library index cards or catalogue entries, keywords embedded at the top of web pages, (Exif) information in image files etc. It is there to help locate the information itself.

(b) Infra-Red, WiFi, Bluetooth and GPRS are all wireless communication technologies. Choose any two of these and compare and contrast them in terms of the technology and how it is used. [4 marks]

Infra-Red involves point to point communication over a light beam. Communicating items have to be close and pretty much line of sight. Typical application would be communicating between a mobile phone and a PC or between a PC and a printer.

Bluetooth also involves communication between physically close items though it over radio and the protocol is more sophisticated and allows secure communication between small closed groups.

Both are designed to replace short-range wired connections.

WiFi is an exact wireless (radio) analogue of a connection to a LAN. WiFi access points will have a range of a corridor or so. WiFi is a much more

general network connection than Bluetooth or Infra-Red and will allow access to the full range of Internet services.

GPRS is the digital partner of mobile phone voice services. GPRS will have a range of a mobile phone cell but then connects directly into the mobile pphone network offering modem and limited Web/email services.

- (c) Explain how errors are detected and corrected when two computers communicate. [2 marks]

[comms 1 (8)] Data is sent in packets with redundant information (CRC). If the computed CRC doesn't match the transmitted CRC an error has occurred and the packet needs to be retransmitted. Words such as 'parity', 'protocol' will also gain part marks.

- (d) What is identity theft? Describe one possible mechanism and the likely consequences for the victim. [3 marks]

It is the process of deceiving the victim into divulging personal information that can then be used to impersonate that person, usually for financial gain. Phishing – emailing out 'security alerts', competition win notices etc. with a link that goes to a bogus version of an apparently legitimate web sit. The user types in personal details which are then use to raid that person's accounts. Other mechanisms include snooping on keystrokes, raking through waste bins for paper credit card receipts, doing the electronic equivalent by using viruses, trojans or the like to scan the victim's computer Compromised ATM machines - any plausible mechanism accepted. Consequences include financial loss but can result in criminal charges for fraud etc.

- (f) Compare and contrast the risks and protection offered through purchasing an item over the internet via a credit card versus a debit card, EFTPOS or electronic money system such as PayPal. [4 marks]

Several slides on this: Credit card – supplied on demand at a web site; If compromised gives access up to the credit limit on the card but the user is protected against fraud and dodgy retailers by the Consumer Credit Act 1974 sects 75 and 83. Electronic money systems such as PayPal are 'charged up' with cash before use so the exposure is limited to the balance but there is no CCA protection. Debit cards and EFTPOS have no CCA 1974 sect 75 protection and will expose the user to the extent of their balance (but not overdraft as this is credit). Banks have some voluntary protection here. And more could be said.

- (g) Describe how you would ensure that a web site you were creating attracted visitors, was easy to use, easy to maintain and was effective. [5 marks]

There was a whole lecture on this. Design of the top page to be attractive, professional and to give a rapid overview of what the site was about. Subsequent pages should be easy to navigate, free of dead-ends, dead links etc.. The site should be aimed at what the target audience will want (not

what the author imagines it to be). The site may require additional advertising in other media. Care should be taken to make it prominently visible to search engines. Site should be kept up to date. Maintenance should be kept to a minimum by means such as CSS. Etc. etc. Lecture concentrated on function, style and content.

- 3 (a) Describe the nature and function of a *mainframe* computer. [2 marks]

Large corporate/institutional central machine; fixed pattern of work, e.g. payroll, reconciliation of trading positions, transaction processing. Centralized, multifunction, possibly company critical.

- (b) Describe the notion of an embedded computer and give an example. What is the relevance of 'firmware' in this context? [3 marks]

Embedded computers are built-in special purpose machines that perform specific tasks [1pt]. [1pt] for example, e.g. climate control inside a modern office building. Embedded computers generally have their programs etched in silicon so they can't be altered i.e. 'firmware' [1pt].

- (c) Windows filing systems delete files by returning the blocks to a free list and removing the file name entry from the 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 kept in mind when disposing of a PC (or doing anything criminal or subversive on it)

- (d) One function of a DBMS is to maintain data integrity. What problems would you expect when using a database that did not have this property? [2 marks]

There would be inconsistencies in the way the data was represented – a search might or might not find the desired item, depending on how it was entered. If a database loses integrity it will drift further and further away from an accurate representation of the world and searches will generate incorrect, incomplete or inconsistent results.

- (e) What is the general notion of an effective procedure? [3 marks]

An effective or 'mechanical' procedure is a finite set of instructions for manipulating symbols, where the symbols can be manipulated without knowing what they mean or what the manipulations are supposed to accomplish.

- (f) Recall the stone age model of computation: *viz.* a caveman with a pile of stones and a potentially unlimited supply of numbered boxes. The caveman can follow only two instructions: (i) add a stone to box number *n*, (ii) remove a stone from box number *m*, if it's not empty. In principle, is there

anything that a modern supercomputer can compute that the caveman can't
– why or why not? [4 marks]

No, in principle (i.e. abstracting away from practical issues concerning space-time limitations), the caveman can compute anything that it is possible to compute. That's because he's a version of the Lambek (infinite) abacus machine, which is computationally equivalent to the TM framework, and the Church-Turing thesis holds this framework to capture the class of all computable functions. Any given supercomputer will have actual storage and processing time limitations and hence will in practice be able to compute less.

- (g) What is hexadecimal notation, and why is it useful when talking about bytes? Be specific. [4 marks]

Hexadecimal is a base 16 number system, i.e. each 'place' from right to left represents an ascending power of 16 rather than 10, as in our standard decimal system. It's useful because bytes can be expressed using just two digits in hex – take the first 4 bits and interpret them as a binary number. The largest number we can get with 4 digits in binary is 1111, which equals fifteen and hence can be expressed as a single digit in hex (since it's less than sixteen to the first). Do the same for the last 4 bits, and then put the two digits together to code the byte.

- 4 (a) Describe three different kinds of computer-mediated communication and some benefits and drawbacks of each. [3 marks]

(i) email. Benefits: speed, convenience, location independence, asynchronicity (as in different time zones). Drawbacks: can be forged, not guaranteed delivery, spam, flaming, etc.

(ii) IRC-style chat. Benefits: more immediate and conversational. Drawbacks: less permanent, not everyone uses it.

(iii) Desktop video. Benefits: sense of who you're speaking to, convenience. Drawbacks: generally poor sound, no eye contact. All suffer from loss of body language cues, and chat suffers from lack of sync. Other examples could include email lists, news groups, bulletin boards, etc.

- (b) Explain how the interaction of computer networking and database technology can lead to privacy problems. [3 marks]

Information about an individual may be entered into one database and be considered private, protected and secure. Some or all of the entry may be communicated to other databases and eventually used in a way that breaches privacy legislation. Computer networks linking databases make this much more likely.

- (c) What is the computational paradigm in AI? What is the mind/program analogy and why is it important? [4 marks]

Computational paradigm explains human mental states and thinking as complex information processing states that mediate the inputs and outputs of behavior – just like in a computer [1pt]. Hence the allied mind/program analogy holds that the mind is to the physical brain as the program is to the hardware of a computer [1pt]. It's important because it provides a model for how the mind and brain are related (the mind/body problem) and thus how 'abstract' mental processes can lead to physical effects [2pt].

- (d) Describe the Eliza program and the design strategy behind it. [3 marks]

The Eliza program was created in 1964 to show that it doesn't take sophisticated linguistic theories to give the appearance of intelligent conversation. Uses strategy of key-phrase matching – stores a set of key phrases and words and looks to match these to the input sentences in order to generate a plausible output. Still the basic strategy used by most contemporary chatbots and Turing test hopefuls.

- (e) What is meant by each of the following three properties of human language? Which is most likely to present problems for automatic translation systems and why?

- i. Displacement
- ii. Openness
- iii. Prevarication

[4 marks]

- (i) *Displacement: denoted objects/facts may be quite distant in space and time from the communicative act.*
- (ii) *Openness: the inventory of denotables isn't fixed and can expand indefinitely.*
- (iii) *Prevarication: it's possible to mislead, joke, lie, produce fiction.*

- (f) Anonymity is a distinctive feature of internet communication. Describe two positive and one negative aspect of internet anonymity. [3 marks]

Positive: can promote fairness, since those on the receiving end will be less influenced by prejudices and subjective impressions; can allow people to exercise a more egalitarian role, since those on the sending end might feel less intimidated about expressing their views. Negative: can make people less constrained by norms of what's socially acceptable, can be used to deceive and mislead.

Part "B"

Answer ONE question only from this section

- B1.** Choose an example of a company that could not remain in business without modern communications and IT. Explain how Information Technology underpins the business and what economies might be possible as a result. [20 marks]

Examples that come to mind are Amazon, eBay, Google, Dell computers, any mobile phone company, companies offering mobile or Web content services and so on. Actually most modern companies couldn't be competitive without C&IT. Essay could talk about new customer interfaces or means of distribution (e.g. Web or Mobile).

There was also an example in lectures of a call-centre having access to product catalogues and stock levels, feeding information about sales and enquires back to central office to aid planning. Staff who are on the move can be kept in touch via email. Legacy systems can be interfaced to more modern systems using middleware as can different systems that contribute to the business as a whole. Service industries such as trains and airlines have rapid and up to date access to passenger numbers and can analyse these to adjust tariffs and schedules to optimise profit. Using just-in-time technologies can reduce inventory within a manufacturing process or of completed goods in warehouses. This question is an opportunity to discuss how modern business is driven by IT. Marks will be awarded for anything that indicates an awareness of how modern companies use the technology.

- B2.** Describe some normal and some undesirable forms of social or commercial relationships that occur between people over the Internet. In what ways do these relationships differ from the equivalent relationships in the 'real world'? [20 marks]

Recycled from 2005 resit paper. Normal social or commercial relationships – friend-friend, boyfriend-girlfriend, interest group, workplace, team .. Differences are that they are not face-to-face (though may be supported by real-world interaction or audio and video) and body-language or social status cues are not always available and have to be simulated by smileys etc. Distance however disappears (other than the effect of time zones) so relationships can be conducted over a considerable distance e.g. if a couple are separated or a business team distributed world-wide.

Undesirable relationships would include predation, harassment or stalking where anonymity is a factor as is access to people. Paedophiles would not normally get direct 1:1 access to children but can in chat rooms. Scammers

gain access to millions of people via spam. Fraudsters can put up a professional-looking Web page with nothing behind it.

The question provides an excuse to talk about most aspects of internet-mediated interaction between people and any sensible comparisons will get marks.

- B3.** John Searle's Chinese Room argument is designed to undermine the claim that the Turing Test provides an adequate criterion for machine intelligence. Write an essay discussing the Turing Test and Searle's objection. Do you think Searle is right – why or why not? [20 marks]

The (standard) Turing Test is the well-known conversational 'imitation game'. The game involves three players: a human interlocutor plus another human and a computer that are questioned in a manner that preserves anonymity. The interlocutor can ask questions on any subject and after a set amount of time must judge which is the human and which is the computer. If he judges incorrectly the computer wins. Turing claims that any computer that can win the game a sufficient proportion of times should be deemed intelligent. Searle's Chinese Room argument is meant to refute Turing's claim. He imagines a scenario in which he knows nothing about the Chinese language, is locked in a room with a giant rule book written in English that tells him how to manipulate Chinese syntax. He's handed bits of paper through the mail slot, which are questions posed during a Chinese 'Turing Test'. By simply following his instructions for manipulating Chinese symbols Searle passes the test. He's done this by serving as a human implementation of a syntax-churning program, but has absolutely no understanding of Chinese or the questions he's been asked and answered. Is Searle right?

- B4.** We now live in an 'Information Age' and many aspects of human culture are undergoing radical change. As with most changes, there are both benefits and drawbacks. Write an essay discussing what you take to be the most important spheres of impact of information technology, and the primary positive and negative effects. What factors and considerations help reduce the negative aspects of change, and help us to make an informed choice about the way we live and the direction in which society is going? [20 marks]

A number of spheres of impact might be discussed, including communication and human interaction, work and business, environment, lifestyle and entertainment, health, education, crime, etc. Some benefits: access to information, people (communication), flexibility in work patterns, location independence, new forms of experience/entertainment, new media for artistic creativity, 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, passive consumerism where people inhabit other peoples' created digital words rather than real life, 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). A potential point for discussion is that real choice guides the future direction of society, rather than just profit motives and/or laziness.