Examiners' commentary 2017–2018

CO1110 Introduction to computing and the internet – Zone B

General remarks

The examination was set generally to test candidates' basic and deeper understanding of the material contained in the subject guide; Introduction to Computing and the Internet (Volumes 1 and 2). The examination was split into two parts, A and B. In Part A candidates had to show their understanding of computer architecture, data representation and operating systems. In Part B candidates were tested on their understanding of computer networks, network protocols, the Internet, computer viruses, the Computer Misuse Act and the Data Protection Act. Candidates had to attempt two questions from each part, and in general, did well in this examination.

Comments on specific questions

Part A

Question 1

This question encouraged candidates to demonstrate their understanding of different number systems i.e. binary and hexadecimal, integer and fraction representation. The majority of candidates attempted this question and scored a high mark.

Part (a) consisted of three multiple-choice questions, which were generally well answered. A good understanding of the two's complement notation, its range and the notion of overflow were required to achieve a high mark.

In Part (b), candidates had to demonstrate their understanding of the concept of overflow and how two's complement notation is used to perform arithmetic operations, i.e. addition and subtraction. A number of candidates failed to answer the part related to overflow correctly.

In Part (c), candidates had to demonstrate a general understanding of the IEEE 754 single-precision binary floating-point format; the sign, the exponent and the mantissa.

This part was generally well answered.

Candidates were asked to represent the decimal number -33.75 in an IEEE 754 single-precision binary floating-point format. A model answer for this question is as follows:

- -33.75 is a negative number, hence the sign-bit is 1.
- 33.75_{10} = 100001.11 = 1.0000111 * 2^5 . Hence, the real exponent is equal to 5.
- The biased exponent is then equal to 132 (5+127), which is 10000100_2 in binary.
- The real mantissa = 1.0000111. hence, the normalised mantissa is 000 0111 0000 0000 0000 0000.
- finally, -33.75 = 1 10000100 000 0111 0000 0000 0000 0000.

In part (c) (ii) candidates were asked to give the range of positive expressible numbers in IEEE 754 that leads to positive underflow in this normalised representation (positive number less than 2^{-126}). A large number of candidates failed to answer correctly.

Question 2

This question aimed to test candidates' understanding of computer memory storage, the central processing unit (CPU), the address bus and cache memory and its role in enhancing computer performance.

Part (a) was a multiple-choice question related to computer memory storage and was successfully completed by the majority of candidates.

Part (b) was related to the central processing unit and the system bus.

> *For a computer memory which consists of a number of 256 x 8 RAM chips, candidates were asked to find the number of memory chips needed to provide a memory capacity of 4096 bytes, the number of lines of the address bus that must be used to access 4096 bytes of memory, the number of lines used for a chip selection and the number of lines common to all chips.*

A large number of candidates failed to answer this question correctly. The answer is as follows:

- The number of memory chips needed to provide a memory capacity of 4096 bytes is: 4096 / 256 = 16 as the capacity of each chip is 256 x 8 RAM = 256 bytes.
- The number of lines of the address bus that must be used to access 4096. bytes of memory is 12 as $4096 = 2^{12}$.
- The number of lines used for chip selection is 4 as we have 16 (2^4) chips.
- The number of common address lines to all chips is 12-4 = 8 .

Part (c) tested candidates' understanding of computer cache memory and how it uses locality of reference to enhance a computer's performance. To score a high mark on this question, candidates had to refer to the difference between the speed of the main memory and that of the CPU as well as explain how both spatial and temporal localities are used by the cache memory to enhance a computer's performance.

Question 3

This question aimed to test candidates' understanding of the central processing unit (CPU), the notion of pipelining, and the problems related to it. Overall, the majority of candidates answered this question correctly.

Part (a) consisted of four multiple-choice questions, which were generally well answered. A good understanding of operating system and computer memory management techniques was required to achieve a high mark in this part of the question.

Part (b) contained an example of a sequence of instructions with a five-stage pipeline. Candidates were asked to demonstrate, step by step, how this sequence of instructions would be executed with and without the use of the forwarding technique. This included identifying any type of hazards, pipeline stalls and the time units required to execute the entire given sequence of instructions. A small number of candidates answered this question incorrectly.

Part (c) focused on techniques used by operating systems to manage a computer's memory. Candidates were asked to explain two memory management techniques, simple paging and demand paging, and were required to give correct descriptions of each technique as well as stating their advantages and disadvantages. The majority of candidates answered this question correctly.

Part B

Question 4

This question aimed to test candidates' general understanding of computer networks, network protocols and the role of subnetting

Part (a) was an easy question regarding network protocols and network classes which was correctly answered by all candidates.

Part (b) focused on the understanding of TCP and how cumulative acknowledgements are used in data transmission. In Part (b) (ii) candidates were asked to explain the inefficiency of using cumulative acknowledgements. A large number of candidates answered this part of the question incorrectly. The inefficiency of cumulative acknowledgements can be explained in the following scenario:

> *Assume a situation where the receiver has received packet x-1, followed by packets x+1, x +2, followed by many other in-order packets. The receiver cannot signal to the sender that while it has not received packet x, it has received packet x + 1, followed by a great many other in-order packets. This means that the sender will send again all packets starting with packet x, even though many of them have already been successfully received. This is a potentially large overhead.*

Part (c) focused on the understanding of TCP/IP layering. To score a high mark on this question, candidates needed to give a clear explanation of the TCP/IP layering model, explaining how communication between layers is achieved and give three advantages of layering. The majority of candidates answered this question correctly.

Question 5

Part (a) and (b) of this question aimed to test candidates' general understanding of the HTML web language and how Cascading Style Sheets, CSS, is used in web programming. Part (c) aimed to test candidates' understanding of the practical side of subnetting.

Parts (a) and (b) were correctly answered by the majority of candidates.

Part (c) aimed to test candidates on their technical ability to design a subnet. They were given network address 172.16.0.0 and subnet mask of 255.255.192.0, and were asked the find the number of subnets, the number of possible hosts per subnet, the address of the first subnet, and the range of host addresses in this subnet. The majority of candidates answered this part of the question correctly.

Question 6

The main aim of this question was to examine candidates' general understanding of computer viruses, software patents, The Data protection Act (DPA) and the issues related to it.

Part (a) was a multiple-choice question related to computer viruses and The Data Protection act. This question was correctly answered by the majority of candidates.

Part (b) focused on the understanding of computer security. Candidates were asked to explain what a Trojan horse is in the context of computer security and how a "denial-of-service" attack is mounted and carried out. This part was successfully completed by the majority of candidates.

In Part (c), candidates were asked to write an essay explaining the advantages and disadvantages of the Internet of things (IoT) and describe all security issues that currently needed addressing in the IoT. To achieve a high mark on

this question, candidates had to correctly identify advantages, disadvantages, and security issues. A good structured argument earned candidates more marks.