

Examiners' commentary

2017–2018

CO1110 Introduction to computing and the internet – Zone A

General remarks

The examination was set to test the candidate's basic and deeper understanding of the material contained in the subject guide, Introduction to Computing and the Internet (Volumes 1 and 2). The examination is split into two parts, A and B. In Part A the candidates had to show their understanding of computer architecture, data representation and operating systems. In Part B the 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

The main aim of this question was for candidates to demonstrate an understanding of a different number system (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 given a number in an IEEE 754 single-precision binary floating-point format:

1100 0001 1111 0000 0000 0000 0000 0000

Candidates were asked to find its corresponding decimal number. A model answer for this question is as follows:

- The sign bit is equal to 1, hence it is a negative number.
- The biased exponent = 10000011 = $128 + 2 + 1 = 131$.
- The real exponent = $131 - 127 = 4$.
- The normalised mantissa = 111 0000 0000 0000 0000 0000.
- The real mantissa = 1.111.
- The final value represented = $-(1.1112) \times 2^4 = (-)111102 = -(16 + 8 + 4 + 2) = -30$.

Part (c) (ii) asked candidates to give a representation of positive infinity ($+\infty$) in this 32-bit format. A large number of candidates failed to give a correct answer. The answer is 01111111100000000000000000000000.

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 128 x 8 RAM chips, candidates were asked to find the number of memory chips needed to provide a memory capacity of 2048 bytes, the number of lines of the address bus that must be used to access 2048 bytes of memory, the number of lines used for a chip selection and the number of lines common to all chips.

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

- The number of memory chips needed to provide a memory capacity of 2048 bytes is: $2048 / 128 = 16$ as the capacity of each chip is $128 \times 8 \text{ RAM} = 128 \text{ Bytes}$.
- The number of lines of the address bus that must be used to access 2048 bytes of memory is 11 as $2048 = 2^{11}$.
- The number of lines used for chip selection is 4 as we have 16 (2^4) chip.
- The number of common address lines to all chips is $11 - 4 = 7$.

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 were required to achieve a high mark.

Part (b) contained an example of 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 types 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. Candidates were required to give correct descriptions of each technique as well stating their advantages and disadvantages. The majority 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 a simple 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 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, to explain how communication between layers is achieved, and to give three advantages of layering. The majority 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 answered correctly by the majority of candidates.

Part (c) aimed to test candidates on their technical ability to design a subnet. Candidates were given network address 220.64.130.0 and subnet mask of 255.255.255.248 and were asked to 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 answered correctly by the majority of candidates.

Part (b) focused on the understanding of computer security. The 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 the security issues that currently needed addressing in the IoT. To achieve a high mark

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