Examiners' commentaries 2016–17

CO1110 Introduction to computing and the internet – Zone A

General remarks

The examination was set to test candidates' basic and deeper understanding of the syllabus outlined in the subject guide. 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, and the Computer Misuse and Data Protection Acts. Candidates are instructed to attempt two questions from each part. In general, candidates did well in this examination.

Comments on specific questions

Part A

Question 1

The main aim of this question was to test candidates' understanding of different number systems, e.g. binary and hexadecimal, integer and fraction representation. The majority of candidates attempted this question and scored high marks.

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 this part of the question.

In part (b), candidates had to demonstrate their understanding of memory addressing. Candidates were asked to find the number of bits needed to address a single memory location. This included understanding the concept of a word in computing and the ability to work out the number of bits needed to address a single word. However, a number of candidates failed to answer this part of the question 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 0111 1000 0000 0000 0000 0000

Candidates were then 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 = 100 00010 = 128 + 2 = 130.*
- *the real exponent = 130 – 127= 3.*
- *the normalized mantissa = 111 1000 0000 0000 0000 0000*

- *the real mantissa = 1.1111*
- *the final value represented = $-(1.1111_2) \times 2^3$ = (–)1111.102 = –(8 + 4 + 2 + 1 + 0.5) = –15.5.*

In part (c) ii., candidates were asked to give the range of positive expressible numbers in IEEE 754 that leads to positive underflow in single-precision representation (positive number less than 2^{-127}). A large number of candidates failed to answer this part of the question correctly.

Question 2

This question aimed to test candidates' understanding of computer memory storage and the central processing unit (CPU).

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. Candidates were given the following scenario:

> A Computer system bus with 8 data lines and only one byte (8 bits) can be transferred from the main memory to the central processing unit (CPU). Candidates were asked to find the number of times the memory must be accessed to transfer a 32-bit instruction from memory to the CPU.

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

The number of times the memory is accessed in this scenario is four times (32/8 = 4).

Part (c) tested candidates' understanding of computer memory storage. In part (i), candidates were given a computer memory with 4K words of 32 bits each, and asked to find the total number of memory bits. This question was answered correctly by the majority of candidates. A model answer for this question is as follows:

4K words = $2^2 \times 2^{10}$ words and each word of 32 bits = 25 bits.

Hence, the total number of memory bits is $2^2 \times 2^{10} \times 2^5 = 2^{17}$.

In part (c) (ii) candidates were given the following scenario:

A computer memory with 8 K words of 32 bits each where the smallest addressable memory unit is a byte (8-bits).

Candidates were asked to find the number of bits required for the memory address (to address each memory byte). A number of candidates failed to answer this question correctly. A model answer for this question is as follows:

- *memory capacity = 8K words = $2^3 2^{10}$ words*
- *the word size = 32 bits = 4 bytes = 22 bytes*
- *the total number of bytes = 23 × $2^{10} \times 2^2 = 2^{15}$ bytes*
- *15 bits are needed to address each byte in memory.*

Question 3

This question aimed to test candidates' understanding of operating systems, pipelining and memory management techniques. Overall, the majority of candidates answered this question correctly.

Part (a) consisted of three multiple-choice questions, which were generally well answered. A good understanding of what an operating system is, and knowledge of computer memory management techniques were 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 types of hazards, pipeline stalls and the time units required to execute the entire given sequence of instructions. This question was answered correctly by the majority of candidates.

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 a description of each technique, and state the advantages and disadvantages of each technique. The majority of candidates answered this question correctly.

Part B

Question 4

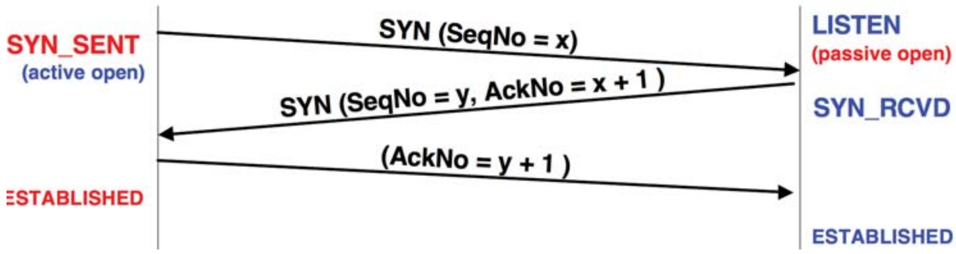
This question aimed to test candidates' general understanding of computer networks, network protocols and the role of subnetting.

Part (a) was a straightforward question regarding network protocols and network classes, and was correctly answered by all candidates.

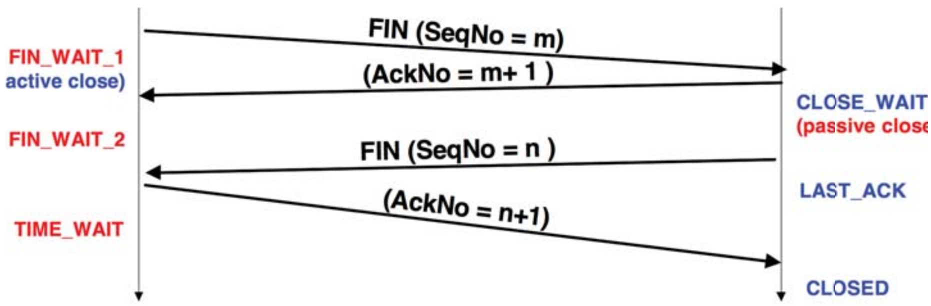
Part (b) focused on the understanding of TCP/IP layering. To score a high mark on this question, candidates needed to give a clear explanation of the TCP/IP layering model. In part (ii) candidates needed to show a clear understanding of how a TCP/IP model deals with lost packets. If the sender receives successive duplicate acknowledgements for the same packet X for example, then the sender should infer that the segment immediately following segment X has not been received, while subsequent segments have been correctly received. The sender should resend the segment immediately following on from segment X. The majority of candidates answered this part of the question correctly.

Part (c) tested candidates' understanding of the concept of the three-way handshake and how it is used when a TCP connection is established or terminated. Candidates were required to give a clear diagram to show the steps for a TCP connection or termination.

TCP connection:



TCP termination:



Question 5

Part (a) and (b) of this question aimed to test candidates' general understanding of the HTML web language and XML. 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. Parts (i) and (ii) were correctly answered by the majority of candidates. However, a large number of candidates failed to answer parts (iii) and (iv) correctly. A model answer for part (c) is given below:

i. *the subnet mask is 255.255.255.248 =11111111 11111111 11111111 11111000 The number of borrowed bits is 5. Hence, the number of possible subnets is* $2^5 - 2 = 30$.

ii. *there are 3 bits representing the host. Hence, the number of possible hosts is* $2^3 - 2 = 6$.

iii. *the address of the first subnet is 223.132.129.8*

iv. *the range of host addresses in the first subset is 223.132.129.9 -- 223.132.129.14*

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 related issues.

Parts (a) and (b) were successfully completed by the majority of candidates.

In part (c), candidates were examined on their understanding of the issues related to transfer of data from an EU country to a non-EU country. To achieve a high mark on this question, candidates had to identify these issues and discuss the measures needed to make the transfer lawful. A good way to tackle this question would be to cover all the steps required to achieve a high level of data security. Credit was given for a good structured argument, showing the importance of these steps, and how each could be achieved.

Examiners' commentaries 2016–17

CO1110 Introduction to computing and the internet – Zone B

General remarks

The examination was set to test candidates' basic and deeper understanding of the syllabus outlined in the subject guide. 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, and the Computer Misuse and Data Protection Acts. Candidates are instructed to attempt two questions from each part. In general, candidates did well in this examination.

Comments on specific questions

Part A

Question 1

The main aim of this question was to test candidates' understanding of a different number system, e.g. binary and hexadecimal, integer and fraction representation. The majority of candidates attempted this question and scored high marks.

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 this part of the question.

In part (b), candidates had to demonstrate their understanding of memory addressing. Candidates were asked to find the number of bits needed to address a single memory location. This included understanding the concept of a word in computing, and the ability to work out the number of bits needed to address a single word. However, a number of candidates failed to correctly answer this part of the question.

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:

0100 0011 0111 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 0, hence it is a positive number*
- *the biased exponent = 1000 0110 = 128 + 4 + 2 = 134*
- *the real exponent = 134 – 127 = 7*
- *the normalized mantissa = 111 0000 0000 0000 0000 0000*

- the real mantissa = 1.111
- the final value represented is:

  $1.111_2 \times 2^7$ = 111100002 = (27 + 26 + 25 + 24) = 128 + 64 + 32 + 16 = 220

Question 2

This question aimed to test candidates' understanding of computer memory storage and the central processing unit (CPU).

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

Part (b) (i) is related to the central processing unit and the system bus. Candidates were given the following scenario:

A Computer system bus with 8 data lines and only one byte (8 bits) can be transferred from the main memory to the central processing unit (CPU). Candidates were asked to find the number of times the memory is accessed to transfer 64-bit instruction from memory to the CPU.

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

The number of times the memory is accessed in this scenario if eight times (64/8 = 8).

Part (b) (ii) tested candidates' understanding of how an optical disk works and how data is read from it.

Part (c) tested candidates' understanding of computer memory storage. In part (c), candidates were given a computer memory with 8K words of 32 bits each and asked to find the total number of memory bits. This question was answered correctly by the majority of candidates.

A model answer to this question is given below:

8K words $=2^3 \times 2^{10}$ words and each word of 32 bits = 2^5 bits.

Hence, the total number of memory bits is $2^3 \times 2^{10} \times 2^5 = 2^{18}$.

In part (c) (ii) candidates were given the following:

A computer memory with 4K words of 32 bits each where the smallest addressable memory unit is a byte (8-bits).

Candidates were asked to find the number of bits required for the memory address (to address each memory byte). A number of candidates failed to answer this question correctly. A model answer is given below:

Memory capacity = 4 k words = $2^2 2^{10}$ words.

The word size = 32 bits = 4 bytes = 2^2 bytes.

The total number of bytes = $2^2 \times 2^{10} \times 2^2 = 2^{14}$ bytes.

Hence 14 bits are needed to address each byte in memory.

Question 3

This question aimed to test candidates' understanding of operating systems, pipelining and memory management techniques. Overall, the majority of candidates answered this question correctly.

Part (a) consisted of three multiple-choice questions, which were generally well answered. A good understanding of what an operating system is, together with the system bus, and the notion of cache hits and cache misses were required to achieve a high mark in this part of the question.

Part (b) contained an example of sequence of instructions with a five-stage pipeline. Candidates are asked to demonstrate, step by step, how this sequence of instructions will 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. This question was answered correctly by the majority of candidates.

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 are required to give a description of each technique, and state the advantages and disadvantages of each technique. The majority of candidates answered this question correctly.

Part B

Question 4

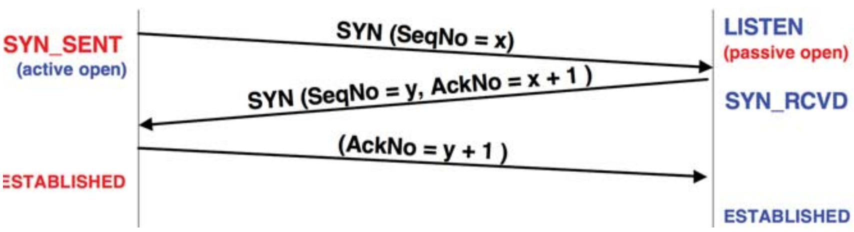
This question aimed to test candidates' general understanding of computer networks, network protocols and the role of subnetting.

Part (a) was a straightforward question regarding network protocols and network classes, and was correctly answered by all candidates.

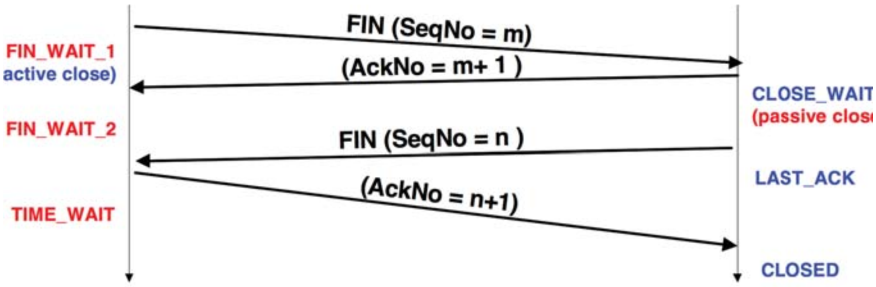
Part (b) focused on the understanding of TCP/IP layering, and to score a high mark on this question, candidates needed to give a clear explanation of the TCP/IP layering model. In part (ii) candidates needed to show a clear understanding of how a TCP/IP model deals with lost packets. If the sender receives successive duplicate acknowledgements for the same packet X for example, then the sender should infer that the segment immediately following segment X has not been received, while subsequent segments have been correctly received. The sender should re-send the segment immediately following on from segment X. The majority of candidates have answered this part of the question correctly.

Part (c) tested candidates' understanding of the concept of the three-way handshake and how it is used when a TCP connection is established or terminated. Candidates were required to give a clear diagram to show the steps for a TCP connection or termination.

TCP connection:



TCP termination:



Question 5

Part (a) and (b) of this question aimed to test candidates' general understanding of the HTML web language and XML. Part (c) aimed to test candidates' understanding of the practical side of subnetting.

Part (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. Parts (i) and (ii) were correctly answered by the majority of candidates. However, a large number of candidates failed to answer part (iii) and part (iv) correctly. A model answer for part (c) is given below:

i. *the subnet mask is 255.255.255.240 =11111111 11111111 11111111 11110000 and the number of borrowed bits is 4. Hence, the number of possible subnets is* $2^4 - 2 = 14$.

ii. *there are 4 bits representing the host. Hence, the number of possible hosts is* $2^4 - 2 = 14$.

iii. *the address of the first subnet is 220.108.192.16*

iv. *the range of host addresses in the first subset 220.108.192.17 -- 220.108.192.30*

Question 6

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

Parts (a) and (b) were successfully completed by the majority of candidates.

In part (c), candidates were examined on their understanding of the issues related to transfer of data from an EU country to a non-EU country. To achieve a high mark on this question, candidates had to identify these issues and discuss the measures needed to make the transfer lawful. A good way to tackle this question would be to cover all the steps required to achieve a high level of data security. Credit was given for a well-structured cohesive argument, showing the importance of these steps and how each could be achieved.