

THIS PAPER IS NOT TO BE REMOVED FROM THE EXAMINATION HALLS
--

UNIVERSITY OF LONDON

CO1110 ZA

BSc, CerTHE and Diploma Examination

**COMPUTING AND INFORMATION SYSTEMS AND CREATIVE  
COMPUTING**

**Introduction to Computing and the Internet**

Tuesday 15 May 2018: 10.00 – 13.00

Time allowed: 3 hours

This paper is in two parts: part A and part B. There are a total of **THREE** questions in each part. You should answer **TWO** questions from part A and **TWO** questions from part B.

Full marks will be awarded for complete answers to a total of **FOUR** questions, **TWO** from part A and **TWO** from part B. The marks for each part of a question are indicated at the end of the part in [.] brackets.

Only your first **TWO** answers from part A and **TWO** from part B, in the order that they appear in your answer book, will be marked.

There are 100 marks available on this paper.

A handheld calculator may be used when answering questions on this paper but it must not be pre-programmed or able to display graphics, text or algebraic equations. The make and type of machine must be stated clearly on the front cover of the answer book.

© University of London 2018

## PART A: Answer TWO questions from this section

### Question 1

- (a) i. Assuming 8-bit two's complement notation, state which of the following represents the result of the addition:  $00001111 + 10101010$

1. 01100101
2. 10111001
3. 01010101
4. 10110101

[2]

- ii. Using 4-bit two's complement notation, in which **ONE** of the following additions does an overflow error occur?

1.  $0011 + 1011$
2.  $1100 + 1100$
3.  $1100 + 0011$
4.  $0100 + 0101$

[2]

- iii. Using 8-bit excess notation, which of the following represents  $-1$ ?

1. 11111111
2. 10000001
3. 00000001
4. 01111111

[2]

- (b) i. Given that the decimal number  $X = 65$  and the decimal number  $Y = -85$ , give their 8-bit two's complement representations.

[2]

- ii. Compute  $X + Y$  in 8-bit two's complement.

[2]

- iii. Compute  $X - Y$  in 8-bit two's complement. Does the result contain an overflow? Explain your answer.

[3]

- iv. Compute  $X - Y$  in 16-bit two's complement representation. Does the result contain an overflow? Explain your answer.

[2]

(c) Assume we are using the 32-bit IEEE single precision floating point format. The mantissa has 24 bits including the hidden bit. There is one sign bit and there are eight exponent bits.

i. What decimal number is represented by the following 32 bits? Show all of your working.

1100 0001 1111 0000 0000 0000 0000 0000

[7]

ii. How would positive infinity ( $+\infty$ ) be represented in this 32-bit format?

[3]

## Question 2

- (a) i. Which of the following are components of the CPU? One or more may apply.

1. ALU
2. cache
3. control unit
4. process control block

[2]

- ii. Part of the operating system is usually stored in ROM so that it can be used to boot up the computer. ROM is used rather than RAM for which **ONE** of the following reasons?

1. ROM chips are faster than RAM.
2. ROM chips are not volatile.
3. ROM chips are cheaper than RAM chips.
4. none of the above.

[2]

- iii. The computer system bus consists of:

1. address bus, data bus and control bus.
2. address bus, data bus and clock bus.
3. address bus, data bus and command bus.
4. none of the above.

[2]

- (b) i. How many 128 x 8 RAM chips are needed to provide a memory capacity of 2048 bytes? [3]

- ii. How many lines of the address bus must be used to access 2048 bytes of memory? [3]

- iii. How many lines must be decoded for chip select? [3]

- iv. How many of these lines will be common to all chips? [3]

- (c) Explain the role of cache memory and how it uses locality of reference to enhance a computer's performance. [7]

### Question 3

(a) i. Which of the following is true about the ready queue?

1. The ready queue holds all the processes in main memory that are ready for execution.
2. The ready queue holds processes that are waiting for an I/O operation.
3. The ready queue hold all processes in the computer system.
4. All of the above.

[2]

ii. A page table is used for which **ONE** of the following purposes?

1. keeping track of the most recently used pages of a process
2. converting logical (or virtual) addresses to physical addresses
3. storing the address of empty frames in main memory for future use as pages
4. none of the above

[2]

iii. Which **ONE** of the following best describes programmed I/O?

1. The CPU issues an I/O command to an I/O module and does other things, checking the status of the command at regular intervals.
2. The CPU sends all I/O commands to an I/O scheduling program for execution.
3. The CPU issues an I/O command and then waits for the command to be completed.
4. None of the above.

[2]

(b) Given the following 5-stage (IF, ID, EX, MEM, WR) sequence of instructions:

$I_1 : ADD$	$r_1, r_4$	$r_5$	$r_6 \leftarrow r_5 + r_5$
$I_2 : ADDI$	$r_2, r_1,$	$\#5$	$r_2 \leftarrow r_1 + 5$
$I_3 : MULT$	$r_3, r_1,$	$r_1$	$r_3 \leftarrow r_1 * r_1$
$I_4 : ADD$	$r_6, r_2,$	$r_3$	$r_6 \leftarrow r_2 + r_3$

- i. Identify all the data hazards in the above sequence of instructions. [2]
  - ii. Assume there is no forwarding. Show how the above sequence of instructions would flow through the pipeline. Indicate pipelining stalls if there are any. [4]
  - iii. Assume there is full forwarding. Show how the above sequence of instructions would flow through the pipeline. Indicate pipelining stalls if there are any. [4]
  - iv. How many clock cycles would it take to execute this instruction sequence **without forwarding** and **with full forwarding**? [2]
- (c) Explain the difference between the following memory management techniques, and list the advantages and disadvantages of each. [7]
- simple paging
  - demand paging



## PART B: Answer TWO questions from this section

### Question 4

(a) i. Which **ONE** of the following is true?

1. Star is not a LAN topology.
2. Ring is not a LAN topology.
3. Spiral is not a LAN topology.
4. All of the above.

[2]

ii. Which **ONE** of the following is **not** true?

1. TCP/IP stands for Transmission Control Protocol/Internet Protocol.
2. TCP/IP implements layering by dividing packets into header and data sections.
3. TCP/IP is part of the OSI networking model.
4. None of the above.

[2]

iii. Which **ONE** of the following is not true?

1. TCP is a connectionless protocol.
2. UDP is a connectionless protocol.
3. UDP is suitable for broadcasting.
4. None of the above.

[2]

(b) i. Describe the cumulative ACK process used in the original Transmission Control Protocol (TCP).

[5]

ii. Why can the cumulative ACK process from the original TCP protocol be inefficient when data packages are lost?

[5]

(c) i. Layering is a restrictive form of data encapsulation implemented in network computing. Name the **FOUR** layers of the TCP/IP network model.

ii. Describe how the TCP/IP model restricts communication between layers, and give **THREE** advantages of layering.

[9]

### Question 5

(a) i. Internet Control Message Protocol (ICMP) is primarily used for

1. addressing
2. error and diagnostic functions
3. forwarding
4. none of the above

[2]

ii. Which **ONE** of the following allows a user to connect and login to a command-line interface on a remote computer?

1. FTP
2. HTTP
3. Telnet
4. none of the above

[2]

iii. HTML was first implemented using:

1. C++
2. SGML
3. Java
4. none of the above

[2]

(b) i. Cascading Style Sheets, CSS, is a way to control the appearance of a web page. Name the **THREE** different methods of implementing CSS. [3]

ii. Describe each method of implementing CSS and give the advantages/disadvantages of each. [7]



(c) Consider a class C network with the network address 220.64.130.0.  
A network administrator decides to subnet this network with a subnet mask of 255.255.255.248. In your answers to the following questions, assume that the all 1s and all zero subnet addresses are not usable.

- i. Find the number of possible usable subnets. [2]
- ii. Find the number of possible usable hosts in each subnet. [2]
- iii. Find the address of the first usable subnet. [2]
- iv. What is the range of possible host addresses in the first usable subnet? [3]

### Question 6

- (a) i. Which of the following best describes a computer worm?
1. malicious code that is designed to slow down your computer
  2. malicious code that spreads itself through a network by exploiting security weaknesses
  3. malicious code that is designed to shut down a server
  4. malicious code that masquerades as a legitimate program
- [2]
- ii. Which of the following could be symptoms of a virus? More than one may apply.
1. start-up, opening files and loading programs are slower than normal
  2. missing files
  3. changes to file access dates and times
  4. all of the above
- [2]
- iii. Which **ONE** of the following about the Data Protection Act 1998 is true?
1. permits disclosure of sensitive personal data for research, teaching and audit purposes
  2. permits disclosure to close family members
  3. includes six principles of data protection
  4. permits disclosure of sensitive personal data (without consent) if this is necessary to protect the health of a third party
- [2]
- (b) i. In the context of computer security, explain what a Trojan horse is. [3]
- ii. How is a “denial-of-service” attack mounted and carried out?  
How does such an attack do its damage? [6]
- (c) The Internet of Things (IoT) refers to the connection of physical devices (computers, smartphones, vehicles, sensors, *etc.*) to the Internet. What advantages and disadvantages do you see in the IoT? Describe any and all security issues that you consider currently need addressing in the IoT. [10]

**END OF PAPER**