

THIS PAPER IS NOT TO BE REMOVED FROM THE EXAMINATION HALLS
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UNIVERSITY OF LONDON

CO1110 ZB

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.

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## 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:  $00011110 + 10010111$

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

[2]

- ii. Using 4-bit two's complement notation, in which of the following additions does an overflow error occur? More than one may apply.

1.  $0111 + 1011$
2.  $1100 + 1101$
3.  $1100 + 0011$
4.  $1100 + 1001$

[2]

- iii. Which of the following represents  $-1$  using 8-bit signed notation?

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

[2]

- (b) i. Given that the decimal number  $X = 66$  and the decimal number  $Y = 100$ , give their 8-bit two's complement representation.

[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? Justify 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. Represent the decimal number  $-33.75$  in this 32-bit floating point format. Show all of your working. [7]

ii. When will a positive underflow occur in this normalized representation? [3]

## Question 2

- (a) i. Which of the following items are components of the CPU? More than one may apply.

1. registers
2. ALU
3. control unit
4. all of the above

[2]

- ii. Given a 32-bit machine, then the length of each word will be:

1. 4 bytes
2. 8 bytes
3. 12 bytes
4. 16 bytes

[2]

- iii. RAM is called DRAM (Dynamic RAM) when:

1. it requires periodic refreshing.
2. it is always moving around data.
3. it can do several things simultaneously.
4. none of the above.

[2]

- (b) i. How many 256 x 8 RAM chips are needed to provide a memory capacity of 4096 bytes? [3]

- ii. How many lines of the address bus must be used to access 4096 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 **ONE** of the following is true about the job queue?

1. The job queue holds all the processes in main memory that are ready for execution.
2. The job queue holds processes that are waiting for an I/O operation.
3. The job queue hold all processes in the computer system.
4. None of the above.

[2]

ii. Virtual memory is implemented using which of the following techniques? More than one may apply.

1. variable sized memory partitions
2. demand paging
3. an intermediate queue to keep track of swapped processes
4. none of the above

[2]

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

1. The CPU issues an I/O command and then waits for the command to be completed; the I/O module sends an interrupt signal when the command has been completed.
2. The CPU issues an I/O command to an I/O module and does other things; the I/O module sends an interrupt signal when the command has been completed.
3. The CPU sends all I/O commands to an I/O scheduling program for execution.
4. None of the above.

[2]

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

$I_1 : ADD$	$r_8, r_5, r_5$	$r_8 \leftarrow r_5 + r_5$
$I_2 : ADD$	$r_2, r_5, r_8$	$r_2 \leftarrow r_5 + r_8$
$I_3 : SUB$	$r_3, r_8, r_4$	$r_3 \leftarrow r_8 - r_4$
$I_4 : ADD$	$r_2, r_2, r_3$	$r_2 \leftarrow r_2 + r_3$

- 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]
- fixed-sized partitions
  - variable-sized partitions



## 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. Polygon is not a LAN topology.
3. Bus is not a LAN topology.
4. All of the above.

[2]

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

1. TCP/IP specifies communication protocols for the Internet.
2. TCP/IP implements layering by dividing data packages into header and data sections.
3. TCP/IP is also known as the OSI networking model.
4. None of the above.

[2]

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

1. TCP is a connection oriented protocol.
2. UDP is a connection oriented protocol.
3. TCP is suitable for email transmission.
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. DHCP (dynamic host configuration protocol) provides \_\_\_\_\_ to the client:

1. an IP address
2. a MAC address
3. a URL
4. none of the above

[2]

- ii. SMTP stands for:

1. Standard Mail Transport Protocol
2. Simple Mail Transfer Protocol
3. Standard Mail Transferral Protocol
4. Streamed Mail Transmission Protocol

[2]

- iii. HTML was first implemented using:

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

[2]

- (b) i. What does it mean to say that HTML is “fault tolerant”?

Give **ONE** example of a fault that HTML will tolerate.

[4]

- ii. Give **THREE** disadvantages of HTML’s fault tolerance.

[6]

- (c) Consider a class B network with the network address 172.16.0.0.

A network administrator decides to subnet this network with a subnet mask of 255.255.192.0. 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 Trojan horse?
1. malicious code that is designed to slow down your computer
  2. malicious code that spreads itself, from file to file and from computer to computer
  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 taking longer than normal
  2. unexpected messages or images on the screen
  3. extra files
  4. all of the above
- [2]
- iii. Which one of the following statements is true?
1. A patent must be registered in order to gain protection.
  2. Copyright must be registered in order to gain protection.
  3. The owner of a patent cannot sell it but can prevent others using their invention.
  4. A patent doesn't have to be registered in order to gain protection.
- [2]
- (b) i. In the context of computer security, explain what a worm 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**