UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

Department of Computing

B. Sc. Examination 2015

IS51009B – RESIT
Data Representation and Architecture Modelling

Duration: 2 hours 15 minutes

Date and time:

There are five questions in this paper. You should answer no more than THREE questions. Full marks will be awarded for complete answers to a total of THREE questions. Each question carries 25 marks. The marks for each part of a question are indicated at the end of the part in [.] *brackets.*

There are 75 marks available on this paper.

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FROM THE EXAMINATION ROOM

Question 1

(a) i. Which one of the following methods of number representation takes the largest amount of memory?

1. sign-magnitude
2. one's complement
3. two's complement
4. Excess notation

[2]

ii. What procedure is required to add the two's complement numbers 01101101 and 101?

1. sign extend the shorter number
2. take the two's complement of the smaller number and extend it
3. pad the shorter number with 0's
4. shift the shorter number to the left by 5 places

[2]

iii. Which of the following statements about IEEE 754 single precision floating point numbers are CORRECT? More than one answer may apply.

1. the exponent is represented in two's complement notation
2. the exponent is represented in excess notation
3. positive underflow occurs when the positive number to be represented is less than 2^{-127}
4. the number 5.2 can be represented exactly.

[2]

(b) i. Register A holds the 8-bit binary number 10001011. Determine the B operand and the logic micro-operation to be performed in order to change the value in A to 01010101.

ii. Perform the following 8-bit two's complement calculation:

$$01110001_2 - 11101101_2$$

iii. Does the above two's complement calculation give an overflow? Justify your answer.

[9]

(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 floating point number is represented by the following 32 bits? Show your workings.

$$1100\ 0011\ 1110\ 1110\ 0000\ 0000\ 0000\ 0000$$

ii. How would infinity (∞) be represented in this 32-bit format?

[10]

Question 2

(a) i. Which one of the following describes what a bootstrap is:

1. a memory device
2. a device to support the computer
3. an error correction technique
4. a small initialisation program to start up a computer

[2]

ii. The part of machine level instruction, which tells the central processor what to do is:

1. operation code (op-code)
2. address
3. operand
4. none of the above

[2]

iii. In which of the following registers is a decoded instruction is stored?

1. PC
2. IR
3. MBR
4. none of the above

[2]

(b) i. Explain how is pipelining used to improve computers' performance.

ii. Provide a short description of the data pipelining hazard.

iii. State and explain a way to reduce pipelining stalls caused by data hazards.

[10]

(c) i. List two advantages of RISC based system architecture.

ii. Explain the concept of the ”temporal locality” principle.

iii. Explainhowthetemporallocalityprincipleisusedbythecachemem- ory to improve performance.

[9]

Question 3

(a) i. Which one of the following storage media has the fastest data access?

1. cache
2. DRAM
3. SRAM
4. registers

[2]

ii. In the memory hierarchy, as the speed of operation increases the memory size also increases.

1. true
2. false

[2]

iii. What is the purpose of registers in the CPU?

1. to transfer data to primary storage
2. to hold data
3. to perform logic operations
4. to decode program instructions

[2]

(b) i. How many 256 x 8 RAM chips are needed to provide a memory capacity of 1024 bytes?

ii. How many lines of the address bus must be used for the above RAM chip selection?

iii. How many lines of the address bus must be used to access 1024 bytes of memory ?

iv. How many of these lines will be common to all RAM chips?

[9]

(c) i. Explain the main function of Input/Output modules.

ii. How does the CPU deal with interrupts?

iii. What is the advantage of Interrupt-driven I/O over Programmed I/O?

[10]

Question 4

(a) i. What is the ready state of a process?

(1) when a process is scheduled to run after some execution
(2) when a process is unable to run until some task has been completed
(3) when a process is using the CPU
(4) none of the above

[2]

ii. Which of the following is not a role of a typical operating system?

(1) control the allocation of the machine?s resources
(2) control access to the machine
(3) maintain records regarding files stored in mass storage
(4) All of the above
(4) assist the computer user in the task of processing digital photographs

[2]

iii. Which of the following is a correct definition of virtual memory?

(1) extremely large main memory
(2) extremely large secondary memory
(3) the illusion of extremely large main memory
(4) the illusion of extremely large secondary memory

[2]

(b) i. Describe the differences among short-term, medium-term, and long-term scheduling.

ii. Why is it generally correct to favour I/O-bound processes over CPU-bound processes?

[9]

(c) i. Describe and state the advantages/disadvantages of the following three memory management techniques.

Swapping
Simple paging
Demand paging

ii. Under what circumstances do page faults occur? Describe the actions taken by the operating system when a page fault occurs.

[10]

Question 5

(a)i. Which class of IP address provides a maximum of $2^8 - 2$ host addresses per network ID?

(1) class A

(2) class B

(3) class C

(4) class D

[2]

ii. Which of the following are TCP/IP protocols used at the Application layer of the OSI model?

(1) IP

(2) HTTP

(3) TCP

(4) SMTP

[2]

iii. Which of the following statements are true regarding ICMP packets? More than one answer may apply.

(1) they acknowledge receipt of a TCP segment.

(2) they guarantee datagram delivery.

(3) they can provide hosts with information about network problems.

(4) they are encapsulated within IP datagrams.

[2]

(b)i. Explain the concept of layering in networked computing.

ii. Explain the role of headers in the TCP/IP model.

[9]

(c) Consider a class C network with the network address 203.175.36.0. A network administrator decides to subnet this network with a subnet mask of 255.255.255.248.

i. Find the number of possible usable subnets.

ii. Find the number of possible usable hosts in each subnet.

iii. Find the address of the first subnet.

iv. What is the range of possible host addresses in the first subnet?

[10]