THE UNIVERSITY OF BUCKINGHAM

SCHOOL OF SCIENCE

Exam Title: **INTRODUCTION TO COMPUTER SYSTEMS + RESIT**

SPRING 2018

EXAMINATION FOR THE DEGREE PROGRAMMES IN

Computing, (All options) January 2017, September 2017

Exam Code: 20182AIAI11AWN

TIME ALLOWED: **2 HOURS**

MATERIALS PERMITTED: **Calculator**

MATERIALS PROVIDED:

INSTRUCTIONS:

1. Answer **THREE** out of the four questions. You must indicate on the cover of your answer book the **THREE** questions that you want the examiner to mark. If you fail to indicate your choice of questions, the first three questions will be marked in the order in which they appear in your answer book.
2. Start each question on a new page.
3. Be tidy: marks may be deducted for untidy work.

Question 1

i) Briefly explain why using GPUs is highly recommended for high-throughput image processing.

(10 marks)

ii) What is the minimum number of binary-bits needed to represent the following? Justify your answer.

a) $(512)_{10}$
b) $(D3E)_{16}$
c) $(67)_{8}$

(15 marks)

iii) Determine the decimal value of the binary string 10110010 assuming it represents:

a) An unsigned integer number
b) A signed two's complement integer number
c) A sign-magnitude integer number

(15 Marks)

iv) Explain, with examples, the differences between CISC and RISC instruction sets.

(20 Marks)

v) Explain, with examples, the difference between computer organisation and computer architecture?

(20 Marks)

vi) Convert the decimal number 269 into:

a) Unsigned Binary
b) Base 6
c) Octal
d) Hexadecimal

(20 Marks)

Question 2

i) Draw a diagram of a simple 2-to-4 memory address decoder circuit to select one memory address out of four available addresses? Briefly explain the function of this circuit.

(15 Marks)

ii) Assume x=5, y=2, and z=5. Evaluate the value of each of the following Boolean expressions (show the evaluation details).

a) (x > 3) OR (y < 5) OR (z ≤ x)
b) (x+y ≥ z) AND [(x>6) OR (z ≤ 5)]
c) [NOT(z >10)] AND [(z=7) OR (y<2)]

(15 marks)

iii) Perform the following computational operations

a) 72 – 102 in a sign-magnitude binary representation
b) 65 + 99 in unsigned 8-binary representation
c) -39 - 100 in a signed two's complement 8-bit representation
d) FF9 + 7BB in hexadecimal

(20 marks)

iv) Consider the IEEE standard for floating-point number representation to:

a) Explain how the number of bits used for the mantissa and the exponent relates to the range and the precision of floating-point numbers.
b) Convert the decimal number -63.3214 into the IEEE standard 32-bit format for floating-point numbers.

(20 marks)

v) A majority-rules logic circuit has three inputs and one output. The value of its output is 1 if and only if two or more of its inputs are 1; otherwise, the output is 0.
Design a majority-rules logic circuit using the sum-of-products algorithm. You may only use AND, OR and NOT gates

.

(30 Marks)

Question 3

i) What are the characteristics of an ideal memory?

(10 Marks)

ii) What would be the maximum memory size that can be addressed by a 32-bit computer system and why?

(10 Marks)

iii) Briefly explain why accessing data on L3 cache is slower than L1.

(10 Marks)

iv) Let the average access time of memory be 20 nsec, and the average access time for a cache memory be 8 nsec.

a) What is the overall average access time if the cache hit rate is 80%?

b) What would the cache hit rate have to be to make the average access time 10 nsec?

(20 Marks)

v) Translate the following algorithm into assembly language using the instructions of the Little Man Computer (LMC)

```
Input Numer1 and Number2
IF Namber1 >= Number2 THEN
        Output Number1
ELSE
        Output Number2
End
```

(25 Marks)

vi) In Von Neumann computer architecture, explain how the PC, IR, MAR, MDR registers are used by the control unit to execute a programme.

(25 Marks)

Question 4

i) Briefly explain the concept of ‘Sampling rate’ and ‘bit depth’ in the context of analogue to digital conversion. Give examples

(15 Marks)

ii) In the context of memory sub-systems, what is the Principle of Locality? Explain how it has been used to improve the overall performance of computer systems.

(15 Marks)

iii) In computer networks, briefly describe the types of communications media to transfer signals from senders to receivers

(20 Marks)

iv) In the context of cloud computing, what is meant by Software as a Service (SaaS) and Platform as a Service (PaaS)? Give examples

(20 Marks)

v) Briefly explain the following:
   a) SDRAM
   b) DRAM
   c) DDR3
   d) IPV6
   e) SRAM

(30 Marks)

- **End -**