Swansea University College of Science

Prifysgol Abertawe Coleg Gwyddoniaeth

January 2018

CSCM53
Computer System Concepts

Time Available: 2 hours

Coordinator: Dr Jonathan Jones

Queries: The Exams Office holds a contact list for this paper

Only University-supplied dictionaries are permitted.

Calculators? Supplied

There are FIVE questions on the paper.
ALL questions will be used for assessment.

1. This question concerns logic gates, and boolean algebra. Be very careful to not miss out values and to use correct symbols and connections.

(a) Assume we have a circuit to represent the following sequence of gates $(A.B) + (\overline{A}.C)$. Draw out the circuit using the standard symbols for gates. [2 marks]

(b) We can use truth tables to represent the input and outputs to these circuits. Construct the truth table for the previously described circuit. [2 marks]

(c) Assuming you only had NAND gates. Use these to represent an AND gate, give the following pieces of information:

i The boolean expression for the gate

ii Draw the truth table for the gate showing ALL gate outputs

[3 marks]

(d) Computer system perform arithmetic using a circuit called an ADDER. Draw a representation of a full adder. [3 marks]

Total [10 marks]

2. This question concerns number representation of numbers and arithmetic.

(a) Convert the following numbers to binary, using 8-bit 2's complement.

i -117

ii 37

iii -69

iv 84

[2 marks]

(b) Using 8-bit twos complement, and showing working out, perform the following calculations.

i 12-67

ii 71+39

[2 marks]

(c) Using a 3 bit mantissa, a 4 bit exponent, with a bias of 7, convert these numbers to decimal.

i 10111110

ii 01000111

[2 marks]

(d) Convert the following unsigned binary numbers to OCTAL.

i 11011001

ii 01011101

[2 marks]

(e) Using 4-bits to represent the whole number part, and 4-bits the fractional part number (i.e 0.0 in decimal becomes 0000.0000 in binary), convert the following into binary.

i 4.875

ii 5.1

[2 marks]

Total [10 marks]

3. The following question is about computer systems, architecture and hardware.

(a) Draw a representation of a *Von Neumann* architecture-based computer. [3 marks]

(b) Simply explain the function of the following components in the *Von Neumann* architecture :

i Arithmetic/Logic Unit (ALU)

ii Instruction register (IR)

iii Program counter (PC)

[3 marks]

(c) Draw a schematic of the four stages of the Fetch/Execute cycle, ensure the relationship between registers and main memory is shown. [4 marks]

Total [10 marks]

4. This question will cover Operating Systems, Networks, and Security.

(a) There are two main categories of software discussed, with operating systems (OS) belonging to one of them.

i What are the software categories, give a brief (1 sentence) to illustrate their function?

ii What category does OS software belong to and why (1 sentence)?

[3 marks]

(b) What are the 3 basic functions of the OS? [3 marks]

(c) What is the fundamental difference between a Circuit Switched and Packet Switched network? [2 marks]

(d) What is a substitution cipher, and how may they be vulnerable to character frequency analysis? [2 marks]

Total [10 marks]

5. This Question covers memory, data storage and file handling

(a) What is the difference between *sequential* and *direct* file access? [1 mark]

(b) Give the advantages and disadvantages of a *Chained* (i.e. Linked) file system. [2 marks]

(c) What is the category of file system used by *Unix* called? [1 mark]

(d) If we assume that we have ordered cylinder requests: $49, 91, 22, 61, 7, 62, 33, 35$ with the Read/write heads at Cylinder 26, a Seek time of $0.1ms$ per track and Latency of $1ms$
What is the access time for those requests using the following systems:

i FCFS

ii SSTF

[2 marks]

(e) Explain how file information is stored in a FAT [2 marks]

(f) What are the four main methods for selecting a partition in *partition memory management*? [2 marks]

Total [10 marks]

End of paper