PAPER CODE NO.	EXAMINER : **Dr. Malcolm Taylor**
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THE UNIVERSITY
of LIVERPOOL

JANUARY 2002 EXAMINATIONS

Bachelor of Arts : Year 1
Bachelor of Engineering : Year 1
Bachelor of Science : Year 1
Bachelor of Science : Year 2

COMPUTER SYSTEMS

TIME ALLOWED : Two Hours

INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions in section **A** and **THREE** questions in section **B.**

If you attempt to answer more than the required number of questions (in any section), the marks awarded for the excess questions will be discarded (starting with your lowest mark).

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SECTION A

Answer **ALL** questions in this section.

A.1 Outline the principal steps carried out by the computer processor in the execution of a single typical machine code instruction. Explain the role of the program counter and of other processor registers in this cycle.

(5 marks)

A.2 Describe briefly the way in which fractional numbers can be represented within the computer using floating-point notation.

(5 marks)

A.3 For each of the following 68000 assembly language instructions, identify and explain the addressing modes being used:

i) move #27,d0
ii) move d0,home
iii) move d0,(a1)

(5 marks)

A.4 Describe briefly the way in which the 68000 processor deals with the storage of subroutine return addresses.

(5 marks)

A.5 Explain the term **elementary logic gate.** Draw logic gate symbols and truth tables for the logic functions **AND, OR, NOT.**

(5 marks)

A.6 What is the function of the **status register** in the 68000 processor? Explain how it is used in the construction of conditional sequences of instructions.

(5 marks)

A.7 Explain the terms **even parity** and **odd parity** in relation to a byte of information. What is the function of a parity bit?

(5 marks)

A.8 Explain what is meant by an **interrupt.** Why are interrupts necessary for the functioning of a multi-user computer system?

(5 marks)

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SECTION B

Answer **THREE** questions from this section.

B.1 The piece of program below, in the 68000 assembly language, is written with the address of each instruction shown as a decimal number in the left-hand column.

(a) Draw up an execution history of the program, tabulating the changes in the values of the PC and the other registers used throughout an execution of the program.

(14 marks)

(b) For each of the instructions at addresses 2004, 2012 and 2016, give a clear explanation of the use and effect of the addressing modes used for each operation.

(6 marks)

```
2000                move #3,d0
2004                move #0,d2
2008                move #0,d3
2012                lea array,a0
2016   loop:        move (a0)+,d1
2018                blt negative
2022                add d1,d2
2023                jmp endloop
2028   negative:    sub d1,d3
2030   endloop:     sub #1,d0
2034                bne loop

3000   array:       dc.w –20,25,-8
```

B.2

(a) Write a 68000 assembly language subroutine called **max** which takes as parameters two integers in the d0 and d1 registers, and returns the maximum of the two integer values in the d2 register. Use the d3 register for any calculations within the subroutine.

(10 marks)

(b) The subroutine in (a) is to be used in a 68000 assembly language program to evaluate the maximum of two integer variables **numa** and **numb**. The maximum value is to be placed in an integer variable **maxno.**

Give the instructions required to accomplish this, including the reservation of the memory locations for the variable **numa, numb** and **maxno.**

(10 marks)

(NB: minor errors in the form of the instructions you write in this question will not be penalised).

B.3

(a) By constructing an extended truth table for the expression, show that the logic expression

f(A,B) = **not** (A **or** B) **or** (A **and** B)

will be true (or logic 1) **if and only if** A = B

(7 marks)

(b) Draw a logic diagram to represent this logic expression.

(5 marks)

(c) A circuit is required which will take as input a byte and produce a single output at logic 1 **if and only** there are an even number of bits set to logic 1 in the byte.

Using as a building block (module) a component to represent the circuit described in (a) and (b), show how a number of such modules can be connected together to produce the required circuit.

(8 marks)

B.4

(a) Describe the main steps carried out by a typical High-Level Language compiler.

(10 marks)

(b) A new UNIX command is required called **swap** which will take the names of two files passed as parameters, and exchange the contents of the two files. Write a UNIX shell script to accomplish this.

Where will the shell script be stored and what action is required to make the script executable?

Show how the **swap** command would be used to exchange the contents of two files called ex1.doc and ex2.doc.

(10 marks)