PAPER CODE NO.	EXAMINER : **Dr Malcolm Taylor**
COMP130	DEPARTMENT : Computer Science Tel. No. **43682/43649**

THE UNIVERSITY
of LIVERPOOL

SUMMER 2002 EXAMINATIONS

Bachelor of Science : Year 2

COMPUTER SYSTEMS

TIME ALLOWED : Two Hours

INSTRUCTIONS TO CANDIDATES

Attempt ***all*** questions in Section A
Attempt any ***two*** question from 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).

SECTION A

Answer **ALL** questions in this section

A1. 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.

(6 marks)

A2. Describe briefly how positive and negative integers are represented in **twos complement** binary notation. Illustrate your answer by showing the representation of the numbers +5 and –5 as 8- bit signed binary numbers.

(6 marks)

A3. Outline the way in which fractional numbers can be represented within the computer using **floating point** notation.

(6 marks)

A4. Distinguish between a memory address of a word in memory and the contents of a word in memory by explaining the function of the following 68000 assembly language instruction

```
add.w  memloc,d1
```

(6 marks)

A5. 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.

(6 marks)

A6. Write a sequence of instructions in the 68000 assembly language which will perform the equivalent of the Java conditional statement:

```
if(p=q)
   equal=1;
else
   equal=0;
```

(6 marks)

A7. Describe briefly the way in which the 68000 processor deals with the storage of subroutine return addresses.

(6 marks)

A8. In the context of computer hardware give brief definitions of the following terms:

i) bus,
ii) half adder,
iii) flip flop.

(6 marks)

A9. Give brief definitions of the following modes of data transmission:

i) simplex,
ii) half duplex,
iii) full duplex.

(6 marks)

A10. Explain the terms **even parity** and **odd parity** in relation to a byte of information. What is the function of a parity bit?

(6 marks)

Section B

Answer **Two** question from this section

B1. 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.

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.

(20 marks)

```
2000                    move #4,d0
2004                    lea array,a0
2008                    move #0,d2
2012                    move #0,d3
2016    loop:           move (a0)+,d1
2018                    bgt positive
2022                    add d1,d3
2024                    jmp endloop
2028    positive:       add d1,d2
2030    endloop:        sub #1,d0
2034                    bne loop

3000    array:          dc.w 26,-70,5,-9
```

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 variables **numa, numb** and **maxno.**

(10 marks)

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

B3

(a) Explain the term elementary logic gate. Draw logic gate symbols and truth tables for the logic functions **AND**, **OR** and **NOT**.

(6 marks)

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

F(A,B) = (A **AND** B) **OR** ((**NOT** A) **AND** (**NOT** B))

Will be true (logic 1) **if and only if** A=B.

(8 marks)

(c) Draw the logic diagram to represent this logic expression.

(6 marks)