C501: Computer Architecture
Assessed Coursework 1

Due date: **13th November 2018**
(Electronic copy by 23:59)

1. **Boolean Algebra and Digital Circuits**

   (a) Simplify the following Boolean expressions to its simplest form. The symbols $\bullet$, $+$, and $'$ represent "AND", "OR" and "NOT" operations respectively. Please show the sequence of steps and state the reduction rules used.

   (i) $E = A \bullet B + B \bullet (A' + A \bullet B)$ (5 marks)

   (ii) $E = (A + B)' \bullet (C + D + F)' + (A' \bullet B')$ (10 marks)

   (b) Use Boolean Algebra to simplify the following expression and then draw the logic circuit for the simplified expression. $E = A \bullet (B + A \bullet B) + A \bullet C$ (10 marks)

   (c) NOR gates as well as NAND gates are considered as universal gates. Build a circuit for the following Boolean expression $E = A \bullet B$ using only NOR gates. Prove that your circuit works, either by using truth tables or Boolean Algebra reduction rules. (15 marks)

2. **Binary Arithmetic**

   Show your working clearly.

   (a) Assume that you use 5-bits to represent a number. Using 2's complement representation for numbers, show the calculations of:

   (i) 9 - 12. (5 marks)

   (ii) -11 - 8. (10 marks)

   (b) Evaluate $\frac{189}{27}$ using Binary Arithmetic. (15 marks)

3. **Floating Point Numbers**

   Show your working clearly.

   (a) Convert the decimal number, -31.01 into IEEE Single Precision format and its corresponding hexadecimal value. (15 marks)

   (b) Using the IEEE Single Precision format, convert the hexadecimal number 0x40F108D4 into binary and decimal. (15 marks)