

# C501: Computer Architecture

## Assessed Coursework

Due date: **15<sup>th</sup> November 2017**  
(Hard-copy to SAO by 16:00)

### 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. Find 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)  $9 - 11$ . (5 marks)

(ii)  $-12 - 10$ . (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, -31.1 into IEEE Single Precision format and its corresponding hexadecimal value. (15 marks)
- (b) Using the IEEE Single Precision format, convert the following hexadecimal number, 40F109D5 into binary and decimal. (15 marks)