FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY

CSC 1104: COMPUTER ORGANIZATION AND ARCHITECTURE

TEST 1 2010 /2011

1. (a) **Use examples to help you explain the difference between Computer Organization and Computer Architecture**

Computer architecture *is concerned with the structure and behaviour of the various functional modules of the computer and how they interact to provide the processing needs of the user. Architectural attributes include the instruction set, the number of bits used, I/O mechanisms, techniques for addressing etc.*

Computer organisation *is concerned with the way the hardware components are connected together to form a computer system. Organisational attributes include hardware details visible to the user e.g. the interfaces, memory technology etc.*

(b) **Give two reasons why you need to study Computer Organization and Architecture**.

- *Students need to understand the computer's functional components, their characteristics, their performance and their interactions.*
- *Students need to understand computer architecture in order to structure their programs so that they run more efficiently on a real machine e.g. in selecting a system to use they should be able to understand the tradeoffs among various components such as CPU clock speed vs memory size*
- *A graduate may be required to select the most cost effective computer for use in an organization*
- *Computer architecture concepts are needed in other courses e.g. how a computer provides architectural support for programming languages and how operating system facilities reinforce concepts in those areas*

2. Give the uses of the following Computer Components:

(i) **Memory**

Stores data and instructions that are currently being used.

(ii) Interfaces (Ports)

Circuitry needed to connect the bus to a device
I/O interfaces must

- *Buffer data onto/off the system bus*
- *Receive commands from the CPU*
- *Transmit information from their devices to the CPU.*

(iii) **Processor**.

- *Decode the instructions and use them to control the activities within the system*
- *It also performs the arithmetic and logical computations.*

3. Given a binary number 10011101_2 find its equivalent in decimal (base ten) assuming that it is:

(i) An ordinary binary number

$10011101 = 2^7 + 2^4 + 2^3 + 2^2 + 2^0 = 128 + 16+8+4+1 = \mathbf{157}_{10}$

(ii) A Sign magnitude number

$11101 = 2^4 + 2^3 + 2^2 + 2^0 = 16+8+4+1 = \mathbf{-29}_{10}$

(iii) A 2's complement number

$10011101 = 01100010 + 1 = 1100011 = 2^6 + 2^5 + 2^1 + 2^0 = 64+32+2+1 = \mathbf{-99}_{10}$

(iv) A signed BCD Number

1001 1101 = ***-9***

4. Given a decimal number 17.5625_{10} find its equivalent in:

(i) Binary

$= \mathbf{10001.1001_2}$

(ii) Hexadecimal

$0001\ 0001.1001_2 = \mathbf{11.9_{16}}$

(iii) A single precision IEEE Floating Point Number

$10001.1001_2 = 1.00011001 \times 2^4$

Exponent = 127 + 4 = 131 = 10000011; fraction = 00011001

0 10000011 00011001 = ***418C8000***

(iv) An IBM (Typical 32 bit) Floating Point Number

$10001.1001_2 = 0.100011001 \times 2^5$

Exponent = 128 + 5 = 133 = 10000101; fraction = .100011001

1000 0101 0100 0110 0100 = ***85464000***

5. Assume the following Product of Sums Boolean expression:

$(A + B + C)(A + \overline{B} + C)\ (\overline{A} + B + C)(\overline{A} + \overline{B} + \overline{C})$

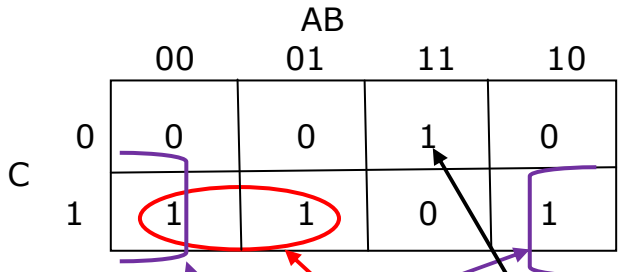
(i) Derive the corresponding Truth Table

A	B	C	X
0	0	0	**0**
0	0	1	**1**
0	1	0	**0**
0	1	1	**1**
1	0	0	**0**
1	0	1	**1**
1	1	0	**1**
1	1	1	**0**

(ii) **Derive the corresponding Sum of Products (SOP'S) expression**

(iii) $\Rightarrow \overline{A}\overline{B}C + \overline{A}BC + A\overline{B}C + ABC$

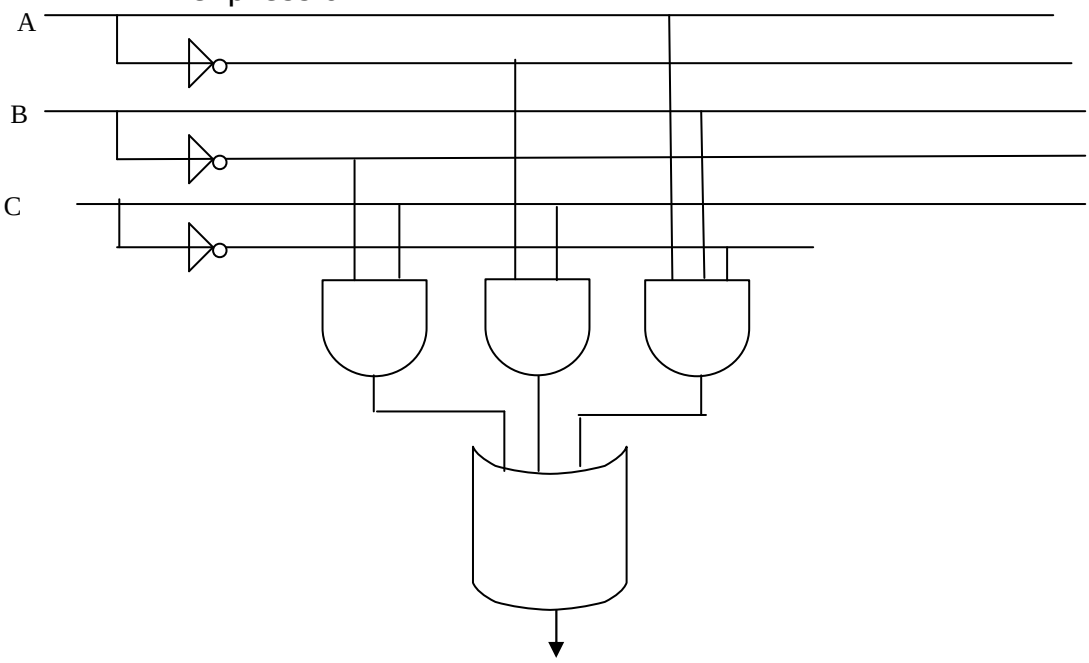
(iv) Draw the corresponding Karnaugh Map



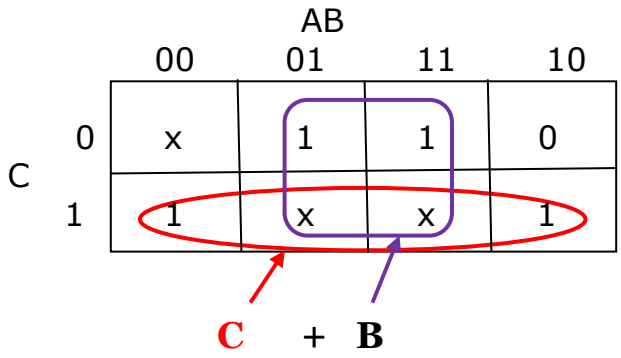
(v) Simplify the expression using Boolean Algebra or otherwise.

$\bar{B}C + A\bar{C} + AB\bar{C}$

(vi) Draw the logical diagram corresponding to the simplified expression.



6. Given the Boolean expression ***F(A,B,C) = Σ(1,2,5,6)*** together with some Don't Care cases ***d(A,B,C)= Σ(0,3,7)*** draw the corresponding Karnaugh Map and simplify the expression.



C + B