MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2012/2013

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE & TECHNOLOGY (MAIN CAMPUS)

CCS 209: COMPUTER ARCHITECTURE AND ORGANIZATION

Date: 18th July, 2013 — *replace* — Date: *18th July, 2013*   Time: *11.00 a.m. – 1.00 p.m.*

<u>INSTRUCTIONS:</u>

SECTION A: Question ONE is COMPULSORY.

SECTION B: Questions 2-5: Answer ANY TWO questions of your choice.

Q1. (a) With the help of examples give a clear distinction between computer architecture and computer organization.

[6 marks]

(b) Outline the **THREE** main characteristics of von Neumann architectures.   [6 marks]

(c) With the help of sketches show a functional view of the computer.   [4 marks]

(d) Assume that the OPcode for SUB is a decimal 7, X and Y correspond to memory addresses 46 and 78 respectively. Write a representation of the instruction SUB X, Y as it would appear in the memory if the format of the instruction is as shown in figure 1.1.
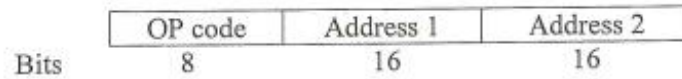
	OP code	Address 1	Address 2
Bits	8	16	16

Figure 1.1.

[4 marks]

(e) Copy and fill table 1.1. for the various Random Access Memory (RAM) sizes.

Table 1.1. RAM sizes

Number of bits per cell	Maximum memory size	Short hand for memory size in bytes
10		
20		
30		
40		

[4 marks]

(f) A computer system is used to control the speed of a motor. An output port is connected to the motor speed, and a signed integer is written to the port to set the motor speed. The computer is configured so that when an OUT instruction is executed, the contents of register 1 are placed on the data bus and sent to I/O port at the address in register 2. Implement the motor speed control via the following methods:

(i) Programmed I / O.   [3 marks]

(ii) memory-mapped I / O.   [3 marks]

SECTION B   {20 MARKS EACH}

Q2. (a) With the help of diagrams explain how a parallel circuit can be used to perform addition or subtraction applying 2'complement system.   [10 marks]

(b) Using a multiplier circuit briefly explain how it can be used to perform binary multiplication of 1101 by 1011.   [10 marks]

Q3. (a) With the help of Memory Address register (MAR), Memory Data Register (MDR) and a decoder circuit briefly describe how data can be stored or retrieved from a RAM system applying

(i) One-dimensional organization   [8 marks]

(ii) Two-dimensional organization   [10 marks]

(b) Briefly outline the shortcomings of the technique used in Q3 (a)(i).   [2 marks]

Q4. (a) With the aid of sketches explain in details how a programmable

interrupt controller is used in the interrupt handling process in a multiple interrupt system. [10 marks]

(b) Using diagrams explain in details how a direct memory access (DMA) operates. [10 marks]

Q5. (a) Briefly outline the effects of the addressing modes of the operands appearing in a machine-language instruction.
[6 marks]

(b) Write an assembly language program that performs the calculation

$$d = \frac{\sqrt{t^3 - 3t^2w + 3tw^2 + w^3}}{t^2 + w^2}$$

where d, t and w are symbolic locations.

Do this using:

(i) One-address system [8 marks]

(ii) Three-address system [6 marks]