UNIVERSITY OF DAR ES SALAAM

Registration Number:

COLLEGE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE CODE & TITLE: IS 139 – INTRODUCTION TO COMPUTER ARCHITECTURE

SECOND SEMESTER FINAL EXAMINATIONS FOR THE ACADEMIC YEAR 2014/15

YEAR OF STUDY: 1

Date: 29th June, 2015

Time: 07:30 – 10:30 Hrs

INSTRUCTIONS:

1. This examination paper consists of …4… printed pages with questions divided into two sections - **Section A (30 marks) and Section B (30 marks).**
2. Answer all questions in **Section A and ANY TWO questions from section B.**
3. Do not use this examination paper for rough work. All rough must be done in the answer book (at the back) and crossed through.
4. This examination paper must be handed in together with your answer book.
5. Unauthorized materials and gadgets such as: All types of mobile Phones and accessories as well as other relevant unauthorized materials Are Not Allowed in the Examination Venues.

SECTION A

Question 1

(a) Explain the differences between data buses, address buses, and control buses. **(3 marks)**

(b) How does a maskable interrupt differ from a non-maskable interrupt? **(2 marks)**

(c) Explain the difference between memory-mapped I/O and instruction-based I/O. **(2 marks)**

(d) Explain the difference between byte-addressable and word-addressable. **(2 marks)**

Question 2

(a) State Moore's Law. Describe 3 implications of this law as related to computer architecture. **(4 marks)**

(b) What technology facilitated the development of microcomputers? Why? **(2 marks)**

Question 3

(a) What kind of circuit selects binary information from one of many input lines and directs it to a single output line? **(1 marks)**

(b) Construct a truth table for the following:
(i) xyz + (xyz)' (ii) x(yz' + x'y) **(2 marks)**

(c) Draw the circuit diagram of the following:
(i) Half-adder (ii) SR Latch **(2 marks)**

Question 4

(a) Name the three ways in which signed integers can be represented in digital computers. Which one of the three integer representations is used most often by digital computer systems? **(2 marks)**

(b) What are the three component parts of a floating-point number? **(1 marks)**

(c) Perform the following base conversions:
(i) 458_{10} to base 3 (ii) 677_{10} to base 5 **(2 marks)**

Question 5

(a) What are the pipeline conflicts that can cause a slowdown in a pipeline? **(2 marks)**

(b) Which is likely to be longer (have more instructions): a program written for a zero-address architecture, a program written for a one-address architecture, or a program written for a two-address architecture? Explain the answer **(2 marks)**

(c) What does the control unit do in relation to instruction execution? **(1 marks)**

SECTION B

Question 6

(a) The first two bytes of a 2M X 16 main memory have the following hexadecimal values:

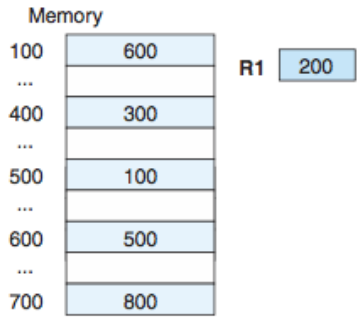
Byte 0 is **FE** and Byte 1 is **01**

If these bytes hold a 16-bit two's complement integer, what is its actual decimal value if:

(i) memory is big endian? **(3 marks)**

(ii) memory is little endian? **(4 marks)**

(b) Consider the following instruction **LOAD 500**. Given that memory and register **R1** contain the values below:



Assuming **R1** is implied in the indexed addressing mode, determine the actual value loaded into the accumulator and fill in the table below: **(8 marks)**

Mode	Value loaded into AC
Immediate	
Direct	
Indirect	
Indexed	

Question 7

(a) Convert the following expressions from reverse Polish notation to infix notation.

(i) XY+WZ-X2+ (ii) WXYZ-+X **(4 marks)**

(b) The memory unit of a computer has 256K words of 32 bits each. The computer has an instruction format with 4 fields: an opcode field; a mode field to specify 1 of 7 addressing modes; a register address field to specify 1 of 60 registers; and a memory address field. Assume an instruction is 32 bits long. Answer the following:

(i) How large must the mode field be? **(2 marks)**

(ii) How large must the register field be? **(3 marks)**

(iii) How large must the address field be? **(3 marks)**

(iv) How large is the opcode field? **(3 marks)**

Question 8

(a) Represent the following decimal numbers in binary using 8-bit signed magnitude, one's complement, and two's complement:

(i) 77 **(3 marks)**

(ii) -42 **(3 marks)**

(b) How many bits would you need to address a 2M X 32 memory if

(i) The memory is byte-addressable? **(2 marks)**

(ii) The memory is word-addressable? (Assume a word is 32 bits) **(3 marks)**

(c) Given a (very) tiny computer that has a word size of 6 bits, what are the smallest negative numbers and the largest positive numbers that this computer can represent in each of the following representations?

(i) One's complement **(2 marks)**

(ii) Two's complement **(2 marks)**