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

SUPPLEMENTARY/SPECIAL EXAMINATIONS FOR THE ACADEMIC YEAR 2014/15

YEAR OF STUDY: 1

Date: 02nd October, 2015

Time: 15:00 – 17:55 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 (6 Marks)

(a) What is Computer Architecture? **(1 mark)**

(b) Briefly explain 4 reasons for studying computer architecture **(2 marks)**

(c) State the principle of Equivalence of hardware and software **(1 mark)**

(d) What are the 4 functions of a general purpose computer? **(2 marks)**

Question 2 (7 Marks)

(a) What is the function of a control unit inside the CPU **(1 marks)**

(b) Mention 2 types of control units **(1 marks)**

(c) Briefly describe 4 properties of a von Neumann architecture. **(4 marks)**

(d) Mention 3 parts of a typical stored-program computer. **(1 mark)**

Question 3 (10 Marks)

(a) Draw the truth table for the following Boolean functions
(i) xz' + y (ii) (x + y)' (iii) x' + y' **(3 marks)**

(b) What are the 2 logic gates that are known as Universal gates? **(2 marks)**

(c) Draw the logic symbols of these 2 Universal gates **(3 marks)**

(d) Draw the circuit diagram of the following:
(i) 2-to-4 decoder (ii) 4-to-1 multiplexer **(2 marks)**

Question 4 (7 Marks)

(a) What is the difference between big endian and small endian instruction formats? **(2 marks)**

(b) What are three reasons that may cause an instruction pipeline to stall? **(1.5 marks)**

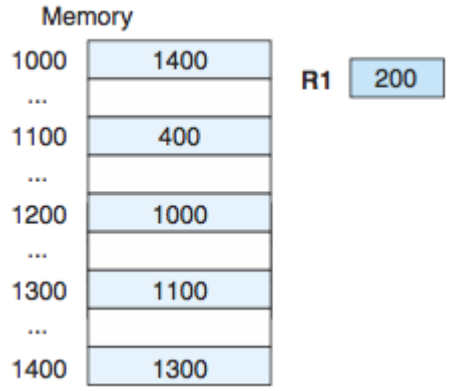
(c) Name the three ways in which signed integers can be represented in digital computers **(1.5 marks)**

(d) Explain the following terms:
(i) Bit (ii) Byte (iii) Word (iv) Nibble **(2 marks)**

SECTION B

Question 4 (15 Marks)

(a) Consider the following instruction **LOAD 1000**. 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	

(b) Assume you have a machine that uses 32-bit integers and you are storing the hex value 1234 at address 0:

(i) Show how this is stored on a big endian machine **(3 marks)**

(ii) Show how this is stored on a little endian machine **(4 marks)**

Question 5 (15 Marks)

(a) A digital computer has a memory unit with 24 bits per word. The instruction set consists of 150 different operations. All instructions have an operation code part (opcode) and an address part (allowing for only one address). Each instruction is stored in one word of memory.

(i) How many bits are needed for the opcode? **(3 marks)**

(ii) How many bits are left for the address part of the instruction? **(3 marks)**

(iii) What is the maximum allowable size for memory? **(3 marks)**

(iv) What is the largest unsigned binary number that can be accommodated in one word of memory? **(3 marks)**

(b) Explain the difference between register-to-register, register-to-memory, and memory to memory instructions. **(3 marks)**

Question 6 (15 Marks)

(a) Simplify the following Boolean expressions using Boolean algebra rules:

(i) xy + xy' **(2 marks)**

(ii) x'yz + xz **(2 marks)**

(iii) wx + w(xy + yz') **(2 marks)**

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

(i) 60 **(3 marks)**

(ii) -30 **(3 marks)**

(c) Convert the following into binary representation:

(i) 160_{10} **(1 mark)**

(ii) $A8_{16}$ **(1 mark)**

(iii) 123_{8} **(1 mark)**