EGERTON UNIVERSITY

UNIVERSITY EXAMINATIONS

REGULAR- NJORO CAMPUS

FIRST SEMESTER 2016/2017 ACADEMIC YEAR

FIRST YEAR RESIT/SPECIAL EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COMP 222: ASSEMBLY LANGUAGE PROGRAMMING

STREAM: BSc. Comp, ECEN. **TIME: 2 HOURS**

SESSION: October **YEAR: 2017**

INSTRUCTIONS

(i) This paper has FIVE questions

(ii) Question ONE is compulsory

(iii) Answer any other TWO questions from the remaining four.

(iv) Extra answered questions will not be marked.

(v) Electronic calculators MUST not be used.

Question One (30 Marks)

(a) Why is it necessary to study the computer's architecture when learning assembly language? **[2 marks]**

(b) What is the difference between a RISC processor and a CISC processor? Give at least two examples for each. **[4 marks]**

(e) Briefly describe the 68K memory organisation. Support your answer with a diagram **[4 marks]**

(f) (i) What are assembler directives? **[2 marks]**

    (ii) What are their three main functions in a program? **[1 mark each = 3 marks]**

"Transforming Lives through Quality Education"
Egerton University is ISO 9001:2008 Certified

(ii)   Illustrating with examples, explain how the following directives are used in a program.   [2 marks each = 6 marks]

    1. EQU

    2. DC

    3. DS

(g)   Write a well-documented 68000-assembly program that adds three long words stored at memory locations $4500 and saves the result in $450C. Your program should illustrate the use of labels and directives DC and DS.   [6 marks]

(h)   What is a pointer register (e.g., one of the 68K's address registers) and how is it used?   [3 marks]

Question One Two (20 marks):

(a)   What is wrong with each of the following 68000 assembly language operations?

    (i)   MOVE.L   D2,A4

    (ii)   ADD.B   D3,#$3004

    (iii)   MOVEA.L   A4,D7   [2 marks each = 6 marks]

(b)   What is the difference between MOVE and MOVEA instructions   [2 marks]

(c)   In principle, there is no difference between a register and a memory location – they both store data. However, microprocessor manufacturers have always aimed to locate as many registers on chip as possible.

    (i)   Why do manufacturers try and put so many registers on the computer chip (i.e., what are the advantages of registers as data storage elements over memory locations)?   [2 marks]

    (ii)   What limits the number of on-chop registers?   [4 marks]

(d)   Draw a memory map to illustrate the effect of the following 68K assembly language directives. You should also carefully explain the effect of each directive and state what it achieves.   [6 marks]

	ORG	$400
Data1	DC.W	$1234
Data2	DC.L	1
Store1	DS.B	4
Data2	DC.L	Data2

Question One Three (20 marks):

(a) Why is it necessary to study assembly language programming? [3 marks]

(b) Using binary arithmetic,

    (i) add the following numbers $7E and $CF and show the effect on the CCR bits (V, C, N and Z). [3 marks]

    (ii) Show the piece of code that performs the operation. [3 marks]

(c) What is the stack in the context of a computer like the 68000? [5 marks]

(d) Define the action of each of the following instructions in RTL (register transfer language). Also state in plain English the action each instruction.

    (i) ADD   D0,D1

    (ii) ADD   #1,D1

    (iii) ADD   (A4),D1 [2 marks each = 6 marks]

Question One Four (20 marks):

(a) Give examples of valid 68K assembly language instructions that use:

    (i) Register-to-memory addressing

    (ii) Memory-to-register addressing

    (iii) Memory-to-memory addressing [2 marks each = 6 marks]

(b) A subroutine in 68K assembly language adds together two 16-bit numbers **X** and **Y** to produce a 32-bit result **W**. The subroutine receives parameters **X** and **Y** by value and returns the result **W** by reference. Explain the meaning of passing a parameter by value and by reference. [2 marks each = 4 marks]

(c) Interpret in words what the following assembly language instructions do.

    (i) MOVE.L   #$8123,D6

    (ii) MOVE.W   D5,(A6)

    (iii) MOVE.B   (A7)+,D4

    (iv) MOVE.W   -(A7),D5

    (v) MOVE.W   -$08(A4),D6 [2 marks each – 10 marks]

Question One Five (20 marks):

(a) The table below gives the list of some of the shift operations. Study it carefully and copy and fill the left out blanks.

[2 marks each = 6 marks]

	Shift Operation	Initial value	After First Shift	CCR XNZVC	After Second Shift	CCR XNZVC
(i)	ASL	01111110				
(ii)	LSR	01111110				

(b) The 68K can operate with **Byte**, **Word** and **Longword** operands.
   (i) What does this mean?
   (ii) Which type of operand do you use in any particular circumstance?

[3 marks]

[1 mark]

(c) Suppose that D4 contains $1237AF9D_{16}$ and D6 contains $B29FEEA6_{16}$. Perform the operations. In each case comment on your answer and the state of the CCR flags

   (iii) ADD.B   D4,D6,
   (iv) ADD.W D4,D6, and
   (v) ADD.L   D4,D6.

[2 marks each = 6 marks]

(d) *Address register indirect addressing* is one of the most powerful and useful addressing modes implemented by a computer. Explain why this statement is true (in the context of the 68000 microprocessor). You should explain what this addressing mode does and give examples of its application.

****

[4 marks]