EGERTON UNIVERSITY

UNIVERSITY EXAMINATIONS

NJORO CAMPUS

SECOND SEMESTER 2008/2009

SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

COMP 202 – ASSEMBLY LANGUAGE PROGRAMMING

STREAM: COMP ICEN, MENT **TIME:** 2 HRS

DAY: THURSDAY: 12.00 NOON – 2.00 P.M. **DATE:** 07-05-2009

INSTRUCTIONS:

1. Answer THREE questions in all. Question ONE is compulsory.
2. Start each question on a fresh page.
3. Electronic calculators MUST not be used

QUESTION ONE: [30 marks]

(a) What are the advantages of on-chip registers over memory locations as a means of storing data? [4 marks]

(b) The 68K has address and data registers (unlike most processors that have general-purpose registers that can be used for addresses and data). What, in the context of the 68K, is the difference between address and data registers? In what ways do the 68K's address and data registers behave differently? [5 marks]

(c) Define the action of each of the following instructions in RTL (register transfer language). Also state in plain English the action each instruction.
[2 marks each total = 6]

(i) ADD D0,D1
(ii) ADD #1,D1
(iii) ADD (A4),D1

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

(e) Suppose that D0 contains $1237AF9D_{16}$ and D1 contains $B29FEEA6_{16}$. Perform the operations ADD.B D0,D1, ADD.W D0,D1, ADD.L D0,D1. In each case comment on your answer and the state of the CCR flags. (The purpose of this problem is to demonstrate the difference between .B, .W, and .L operations)
[5 marks]

(f) Write a well documented program that pass two parameters to a subroutine by reference and receive the result back by value. The program calls a subroutine Calc(X,Y,Z) where parameters X and Y are passed by reference and word parameter Z is returned by value. The subroutine calculates Z = X2 + Y2
[6 marks]

QUESTION TWO [20 marks]:

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

(i) Register-to-register addressing
(ii) Register-to-memory addressing
(iii) Memory-to-register addressing
(iv) Memory-to-memory addressing [1.5 marks each total = 6 marks]

(b) A subroutine in 68K assembly language adds together two 16-bit numbers P and Q to produce a 32-bit result R. The subroutine receives parameters P and Q ***by value*** and returns the result R ***by reference***

(i) Explain the meaning of passing a parameter by value and by reference.
[4 marks]

(ii) Write a 68K assembly language program to implement this subroutine. Remember that parameters P and Q are passed by reference and the result returned by value. [6 marks]

(c) By means of a memory map explain the effect of the following sequence of 68K assembly language directives.

```
        ORG     $1000
        DS.L    2
        DC.L    2
        DC.B    '1234'
Time    DC.B    6
Top     DS.B    6
BSc1    EQU     2
IT1     EQU     3
SE1     DS.B    IT1+BSc1
```
[4 marks]

QUESTION THREE [20 marks]:

(a) Explain why the following assembly language and RTL constructs are incorrect.

(i.) MOVE.L D3,#4
(ii.) MOVE.W [D3],D2
(iii.) MOVE.B (D3),D2
(iv.) [D3]←A0 + 3
(v.) [D3]←#3
(vi.) 3 ← [D3] [1 mark each total 6 marks]

(b) What is an assembler directive? What is the difference between P DC.W 2 and Q DS.W 2? [6 marks]

(c) In assembly language for the 68K, what are the meanings of the symbols $, % and #? [4 marks]

(d) What is the different between MOVE.W #1234,**D0**, MOVE.W 1234,**D0** and MOVE.W (A4),**D0**? [4 marks]

QUESTION FOUR [20 marks]

(a) What is the stack in the context of a computer like the 68000? [4 marks]

(b) Describe how a microprocessor like the 68000 implements a subroutine call and return mechanism. In particular, demonstrate how this mechanism deals with nested subroutine calls. Your answer must include one or more diagrams [6 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 [5 marks]

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

QUESTION FIVE [20 marks]

(a) Draw a series of diagrams (i.e., memory maps that show the stack and the stack pointer) to illustrate the following sequence of actions. You should draw a diagram to illustrate the state of the stack after each instruction has been executed. Give the value of the stack pointer in hexadecimal at the end of each instruction. Take note of the difference between .W and .L operations. [15 marks]

(i) MOVE.L #$4000,**A7**

(ii) MOVE.W #$1234,**-(A7)**
(iii) MOVE.W #$2000,**-(A7)**

(iv) MOVE.L #$44444444,**-(A7)**
(v) MOVE.L (A7)+,**D0**
(vi) MOVE.W #$2222,**-(A7)**
(vii) MOVE.W (A7)+,**D1**
(viii) MOVE.W (A7)+,**D2**
(ix) MOVE.W (A7)+,**D3**

(b) "***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. [5 marks]

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