Philadelphia University

Faculty of Engineering

Dept. of Computer Engineering

Final Exam, Second Semester: 2010/2011

<table>
<thead>
<tr>
<th>Course Title:</th>
<th>Microprocessors</th>
<th>Date:</th>
<th>07/06/2011</th>
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<tr>
<td>Course No:</td>
<td>0630371</td>
<td>Time Allowed:</td>
<td>2 Hours</td>
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<tr>
<td>Lecturer:</td>
<td>Dr. Qadri Hamarsheh</td>
<td>No. Of Pages:</td>
<td>5</td>
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Information for Candidates

1. This examination paper contains 6 questions totaling 50 marks.
2. The marks for the questions are:
   - Question 1 (10 marks), Question 2 (10 marks), Question 3 (10 marks),
   - Question 4 (5 marks), Question 5 (5 marks), Question 6 (10 marks),

Advice to Candidates

1. You should attempt ALL requested parts.
2. You should write your answers clearly.

Basic notions: The aim of the questions in this part is to evaluate the required minimal student knowledge and skills. Answers in the pass category represent the minimum understanding of IA-32 Processor Architecture, Assembly Language Fundamentals: Instructions, Directives, Identifiers, Defining Data, Symbolic Constants, Data Transfers, Addressing, and Arithmetic instructions Addressing Modes, Conditional and Unconditional instructions, Stack, Pointers, Arrays and Procedures.

Question 1 Multiple Choices

(10 marks)

Identify the choice that best completes the statement or answers the question.

1) Which of these four does NOT comprise a part of the system bus?
   - a) Data bus
   - b) Address bus
   - c) Logic bus
   - d) Control bus

2) Which of the following is NOT one of the three stages of the instruction execution cycle?
   - a) Decode
   - b) Fetch
   - c) Flag
   - d) Execute

3) Hyper-Threading turns a physical processor into how many logical processors?
   - a) 1
   - b) 2
   - c) 3
   - d) 5

4) From quickest to slowest instruction execution time, order these three addressing modes:
   - a) Immediate, indirect, direct
   - b) Direct, indirect, immediate
   - c) Immediate, direct, indirect
   - d) Indirect, immediate, direct

5) INT 21 service 01H is used to read character from standard input with echo. It returns the result in _____ register.
   - a) AL
   - b) BL
   - c) BH
   - d) CL

6) If CS = 0701H, SS = 0801H, SI = 0100H and IP = 0108H the address of the next instruction is:
   - a) 07090H
   - b) 07811H
   - c) 07110H
   - d) 07118H

7) The term ‘ISR’ refers to an:
   - a) instruction set register
   - b) immediate service register
   - c) internal system reset
   - d) interrupt service routine
8) Assuming that AX, BX hold unsigned numbers, the condition “jump to label HELP if AX is LESS than BX” can be written in assembly as:

   a) CMP AX, BX
      JBE HELP
   b) CMP AX, BX
      JB HELP

9) The instruction XOR AL, 0C0H will:

   a) Invert the leftmost two bits of AL
   b) Clear the leftmost two bits of AL
   c) Set the rightmost two bits of AL
   d) Invert the rightmost two bits of AL

10) In the following data definition, assume that List2 begins at offset 2000h. What is the offset of the third value (5)?

    List2 WORD 3,4,5,6,7

   a) 2006h           c) 2004h
   b) 2003h           d) None of above

Question 2

   a) Put √ in front of correct statement and × in front of wrong one

<table>
<thead>
<tr>
<th>Ñ</th>
<th>statement</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Data transfer instructions can affect the flag bits</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>The registers SP/ESP are used with DS register to locate the next instruction</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>in real mode, a far jump accesses any location within the first 1M byte by changing both CS and IP.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>In real-mode addressing if the beginning segment address is 028FH the memory location having an effective address of 03FFFH lies within the segment.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>After MOV instruction both the contents of the source and destination registers are changed</td>
<td></td>
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</table>

   b) Which of the following instructions is wrong and why

<table>
<thead>
<tr>
<th>Ñ</th>
<th>Instruction</th>
<th>Answer</th>
<th>Reason</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>ADD AL, BX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>POP CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MOV [SI], [DI]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MOV CX, [BX + SI]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>INC CX,2</td>
<td></td>
<td></td>
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</table>
Question 3 (10 marks)
a) Draw the basic components of a computer system (Microprocessor-based) and explain the main function of each component. (3 marks)

| Solution |

b) Describe the “special purposes” of each of the following registers. (2.5 marks)

<table>
<thead>
<tr>
<th>Ñ</th>
<th>Register</th>
<th>special purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>BX</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>DX</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>SS</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>SI</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>IP</td>
<td></td>
</tr>
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</table>

c) Explain the purpose of the TYPEDEF statement. Give the syntax and examples of its use. (2.5 marks)

| Solution |
d) Explain the difference between the carry flag and the overflow flag. (2 marks)

**Solution**

**Familiar and Unfamiliar problems solving:** The aim of the questions in this part is to evaluate that the student has some basic knowledge of the key aspects of the lecture material and can attempt to solve familiar and unfamiliar problems of *Assembly Language Fundamentals: Instructions, Directives, Identifiers, Defining Data, Symbolic Constants, Data Transfers, Addressing, and Arithmetic instructions Addressing Modes, Conditional and Unconditional instructions, Stack, Pointers, Arrays and Procedures.*

**Question 4** (5 marks)

a) Assume that we have the following data definitions: (2 marks)

```
myBytes BYTE  10h, 20h, 30h, 40h
myWords WORD  8Ah, 3Bh, 72h, 44h, 66h
myDoubles DWORD  1, 2, 3, 4, 5
myPointer DWORD  myDoubles
```

Fill in the requested register values on the right side of the following instruction sequence:

```
mov esi, OFFSET myBytes
mov ax, [esi]  ;a. AX =----------
mov eax, DWORD PTR myWords  ;b. EAX =----------
mov esi, myPointer
mov ax, [esi+2]    ;c. AX =----------
mov ax, [esi-4]    ;d. AX =----------
```

b) What will be the stored values in registers AX, BX, CX after the execution of the following program? (3 marks)

```
.MODEL TINY
.CODE
.STARTUP
MOV AX, 2000H
MOV BX, 3000H
MOV CX, 1000H
PUSH AX
PUSH BX
PUSH CX
POP AX
POP CX
POP BX
.exit
```

**Solution**

<table>
<thead>
<tr>
<th>AX</th>
<th>BX</th>
<th>CX</th>
</tr>
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<tbody>
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<td></td>
<td></td>
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Question 5

a) Assume that two 16 bit signed integers are stored in memory locations DS:[SI] and DS:[SI+2]. Write a sequence of instructions that will store the maximum of the two numbers in register CX.

Solution (Code)

b) Write a procedure in assembly that will calculate the value of \( y \):
\[
y = 2x + 10
\]
Assume that the value of \( x \) is already stored in register AX and the value of \( y \) should be stored in BX

Solution (Code)

Question 6

Write assembly language program (complete) that reads a string from the keyboard using interrupt mechanism INT 21, function number 3Fh (Read from file or device a block of bytes) and prints to the printer in reverse order the encrypted version of the entered string using interrupt mechanism INT 21, function number 05h (Write a single character to default printer).

- The code must contain the following:
  - Memory model declaration suitable for MS-DOS applications.
  - The maximum number of the input characters in the string is 128.
  - Prompts user with the message “Enter the plain text”, display it using Irvine library’s procedure WriteString.
  - Use a loop with indexed addressing.
  - Use the stack (push and pop mechanisms).
  - You must generate the key used for encryption each time for each character in the string using the Irvine16.inc library’s procedures RandomRange that generates a pseudorandom integer within a specified range and Randomize that seeds the random number generator.
  - Write the following three procedures in your code and call them as needed:
    - InputTheString to input the string from the keyboard.
    - EncRevString to encrypt and reverse the string.
    - PrintMessage to print in reverse order the encrypted version of the entered string
  - Terminate your program using the termination process of interrupt INT 21, function number 4Ch.

Good Luck