



ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING

FIRST SEMESTER EXAMINATION, 2020/2021 ACADEMIC SESSION

COURSE TITLE: DIGITAL SYSTEM DESIGN WITH VHDL

COURSE CODE: ECE 413

EXAMINATION DATE: MARCH, 2021

COURSE LECTURER: PROF AYODEJI O. OLUWATOPE

ENGR. OYEYEMI OYEWOLE

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HOD's SIGNATURE

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:

1. ANSWER QUESTION ONE AND ANY OTHER THREE QUESTIONS
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

QUESTION #1

- a. Describe the basic concept of the microcomputer design [1 mark]
- b. What is the binary representation of the following hexadecimal numbers? (i) A4693FBC (ii) B697C7A1 (iii) 2B3D9461 [1 ½ marks]
- c. What is the largest decimal value you can represent, using a 129-bit unsigned integer? [1/2 mark]
- d. Describe the address space of the Intel x86 processors (16 & 32 bits) [1 ½ marks]
- e. Describe the basic program execution registers of the Intel x86 processors (16 & 32 bits) [4 marks]
- f. Describe the x86 memory management [1 ½ marks]
- g. Write a short program segment to implement the followings:
 - i. compare signed AX and BX, then copy the larger of the two to a memory location [1 mark]
 - ii. compare unsigned AX and BX, then copy the smaller of the two to a memory location [1 mark]
 - iii. jump to a label EU if bits 15, 9, 6, & 0 are all set [1 mark]
 - iv. jump to a label ECE if the expression unsigned (ECX-EBX) < 0 [2 marks]

QUESTION #2

- a. Describe the instruction execution cycle of a microcomputer system [5marks]
- b. Create a truth table to show all possible inputs and outputs for the boolean function described by $(\neg A \wedge B)$. How would you describe the rightmost column of this table in relation to the table $\neg(A \vee B)$ [5marks]
- c. Write the assembly program language equivalent for the following process expressed in pseudocode [5marks]

```
if ( x == y)
    area = 1;
else
    area = 0;
```

QUESTION #3

- a. Write an x86 assembly program to implement the arithmetic expression given below: Remember to include your algorithm either in flowchart or pseudocode. $A = \frac{1}{2} * B * H$ [6marks]
- b. What is meant by a one-to-many relationship when comparing a high-level language to machine language? [2 ½ marks]
- c. Why would a high-level language not be an ideal tool for writing a program that directly accesses a printer port? [2 ½ marks]
- d. Describe the FOUR steps involved in reading from microcomputer memory [4 marks]

QUESTION #4

- a. Describe the following primary modes of operation of the x86 processor
 - i. Protected mode
 - ii. Real mode
 - iii. System management mode. [3 marks]
- b. How many bytes are contained in each of the following data types? i, word ii. doubleword iii. quadword iv. double quadword [2marks]
- c. Describe the concept of virtual machine and name the four virtual machine levels. [3marks]

- d. Interpret the following assembly program language code segment [7marks]

```
.data
  array WORD 50 DUP(?)
  sentinel WORD 0FFFFh
.code
  mov esi, OFFSET array
  mov ecx, LENGTHOF array
L1: cmp WORD PTR [esi],0
  pushfd
  add esi,TYPE array
  popfd
  loope L1
  jz quit
  sub esi, TYPE array
quit:
```

QUESTION #5

- a. Describe the Assemble-Link-Execute cycle in x86 assembly program language [5 marks]
- b. Implement the following pseudocode in x86 assembly language [5 marks]
- ```
if (a <= b)
 f = 10;
else
{
 f = 6;
 g = 7;
}
```
- c. Write an x86 assembly language segment code that jumps to a label if an integer is even [5 marks]

### QUESTION #6

- a. Write an x86 assembly program to sort the array of integers in ascending order of magnitude. Include your algorithm either in flowchart or pseudocode [15 marks]

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| 300 | 200 | 450 | 350 |
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