

# UNIVERSITY OF ESWATINI

Faculty of Science and Engineering

Department of Computer Science

MAIN EXAMINATION

DECEMBER 2019

Title of Paper: COMPUTER ORGANIZATION AND ARCHITECTURE II

Course Code: CSC 321

Time Allowed: 3 Hours

Total Marks: 100

**Instructions to Candidates:**

*This Question Paper Consists of FIVE (5) Questions. Section A is compulsory.*

*Answer ALL Questions in SECTION A and ONE Question from SECTION B.*

*Marks are indicated in Square Brackets.*

***NB: You Are Not Allowed To Open This Examination Paper Until Permission Has Been Granted By The Invigilator***

# SECTION A

## Question One

[30]

1. Define the following terms:
  - a. Data path [1]
  - b. Assembly language [1]
  - c. Microarchitecture level [1]
2. State the three (3) elements have to be considered when designing the microarchitecture level. [3]
3. State any four (4) advantages of compilers. [2]
4. Describe any two (2) factors that makes a good ISA. [2]
5. Briefly explain why it is not a good idea to have the hardware directly execute high level languages. [2]
6. Is it possible to have zero-address instruction? Explain your answer. [3]
7. Explain the purpose of the following instructions:
  - a. Arithmetic instructions [1]
  - b. Logic instructions [1]
  - c. Test Instructions [1]
  - d. Memory instructions [1]
  - e. I/O instructions [1]
  - f. Branch Instructions [1]
8. List the three (3) main things that are compiler writer should know. [3]
9. Briefly describe any two (2) addressing modes. [6]

## Question Two

[30]

1. Briefly describe how the two-pass assembler works. [3]
2. Write the assembly language equivalent of the following instructions:
  - a. 001000000000111 [2]
  - b. 1001000000001011 [2]
3. Draw the instruction state diagram. [4]
4. List the four (4) categories of microoperations. [4]

5. State and describe the two (2) basic tasks that can be performed by a control unit. [4]
6. Write a MARIE program using a loop that multiplies two positive numbers by using repeated addition. For example, to multiply  $3 \times 6$ , the program would add 3 six times:  $3+3+3+3+3+3$ . [5]
7. Show the Register Transfer Notation (RTN) including the contents of registers for the following program. [6]

Label	Hex Address	Instruction
	100	Load A
	101	Add One
	102	Jump S1
S2	103	Add One
	104	Store A
	105	Halt
S1,	106	Add A
	107	Jump S2
A,	108	HEX 0023
One,	109	HEX 0001

### Question Three

[15]

1. Define the following terms:
  - a. Multicore [1]
  - b. Simultaneous multithreading [1]
2. Briefly describe any two (2) applications that benefit directly from the ability of scale throughput with the increase in number of cores. [2]
3. Describe any three (3) advantages of the use of higher-level cache on the chip. [3]
4. List the four (4) general organizations for multicore systems. [4]
5. List key features of the Heterogeneous System Architecture (HSA). [4]

## SECTION B

### **Question Four**

**[25]**

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1. Define the following terms:
  - a. Interactive system [1]
  - b. Uniprogramming [1]
2. Briefly explain any three (3) services provided by the operating system. [3]
3. List three (3) interfaces found on a typical computer system. [3]
4. Describe the two (2) main problems found in early computer system. [4]
5. Briefly describe the purpose of the following features in a batch system:
  - a. Memory protection [2]
  - b. Privileged instructions [2]
6. Briefly describe long-term scheduling. [4]
7. State three reasons that causes the execution of a process to be suspended. [3]
8. Briefly describe any two (2) advantages of segmentation to the programmer. [2]

### **Question Five**

**[25]**

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1. Define the following terms:
  - a. Process [1]
  - b. Thread switch [1]
  - c. Uniform Memory Access
  - d. Nonuniform Memory Access
2. Describe any four (4) methods of parallel processing. [4]
3. Briefly describe the key design issues of a multiprocessor operating system. [5]
4. List and explain four (4) principal approaches for multithreading. [4]
5. List the operating system design issues found in clustering. [4]
6. List five (5) major actor roles in cloud computing. [5]

## MARIE INSTRUCTION SET

Mnemonic	Binary	Hex	Explanation
JnS	0000	0	Store the PC at address X and jump to X+1
Load X	0001	1	Load the contents of address X into A
Store X	0010	2	Store the contents of AC at address X
Add X		3	Add the contents of X to AC and store the result in AC
Subt X	0100	4	Subtract the contents of address X from AC and store the result in AC.
Input	0101	5	Input a value from the keyboard into AC
Output	0110	6	Output the value in AC to the display.
Halt	0111	7	Terminate the program.
Skipcond	1000	8	Skip the next instruction on condition
Jump X	1001	9	Load the value of X into PC.
Clear	1010	A	Put all zeros in AC
AddI X	1011	B	Add indirect: Use the value at X as the actual address of the data operand to add to AC
JumpI X	1100	C	Use the value at X as the address to jump to
LoadI X	1101	D	Load indirect: Use the value at X as the address of the value to load.
StoreI X	1110	E	Store indirect: Use X the value at X as the address of where to store the value