

KABARAK



UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: COMP 451

COURSE TITLE: MICROPROCESSOR – BASED DESIGN

STREAM: Y4S1

DAY: MONDAY

TIME: 8.30 -10.30 A.M.

DATE: 06/12/2008

INSTRUCTIONS:

1. Attempt question **one** and any other two questions.
2. Question one carries **30** marks and the rest **20** each.

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

- (a) A memory unit has a capacity of 65,535 words of 25 bits each. It is used in conjunction with a general purpose computer. The instruction code is divided into four parts. An indirect mode bit, operation code, two bits that specify a processor register and an address part.
- (i) What is the maximum number of operations that can be incorporated in the computer if the instruction is stored in one memory word. (3)
 - (ii) Draw the instruction word format indicating the number of bits. (1.5)
- (iii) How many bits are there in MBR, MAR and PC for the said memory capacity. (1.5)
- (b) (i) What is a control flow chart? (1)
- (ii) Name two types of blocks used in a flow chart, clearly explaining the function of each of them. (3)
 - (iii) Use a control flow chart to summarize the paths taken by the control unit during an execute cycle. (5)
 - (iv) A bus organized CPU contains 30 processor registers. How many bits are needed to select each source register and destination register? (1.5)
- (c) Distinguish between the following:
- (i) Operation, micro operation and a macro operation (1.5)
 - (ii) Fetch cycle, indirect cycle, execute cycle and interrupt cycles (2)
- (d) Consider two 8-bit binary numbers A = 01000001 and B = 10000100
- (i) Give the decimal equivalent of each number assuming
 - (a) That they are unsigned. (1)
 - (b). That they are signed numbers in 2's complement representation. (1)
 - (ii). Add the two unsigned binary numbers. What is the value of the status bits C, S, Z and V. (5)
- (e) (i) Give the infix notations of the following reverse polish expression.
- $$AB * CD * + EF * + \quad (0.5)$$
- (ii) Perform the logic AND, OR and XOR with two numbers 1001110 and 10101010 (2.5)

QUESTION TWO (20 MARKS)

- (a) Draw a block diagram of an Intel 8080 microprocessor. (5)
- (b) From the table below, List
- (i) List of the control functions. (8)
- (ii) List of the micro operations that execute these instructions. (7)

Operation code	Symbolic function	Description
000	$AC \leftarrow AC + M$	ADD TO AC
001	If $(AC > 0)$ Then $PC \leftarrow m$	Branch If Ac is positive and non- zero
010	$M \leftarrow MBR$	Store in Ac
011	If $(M = 0)$, Then $PC \leftarrow PC + 1$	Increment and skip if zero

QUESTION THREE (20 MARKS)

- (a) It is the function of the control unit to keep track of various cycles that occur during a Computer run. Draw a block diagram of the control unit showing various components that are used in generation of various control functions. (7)
- (b) An instruction is read from memory during the fetch cycle. Show the register transfer relations that specify this process. (7)
- (c) The register transfer micro operation that specifies an indirect cycle. (6)

QUESTION FOUR (20 MARKS)

- (a) The increment and skip instruction is useful for address modification and counting the number of times a program loop is executed. Show
- (i) The macro-statement of the instruction (2)
- (ii) The sequence of micro operation that implements the instruction. (6)
- (b) Distinguish between the following instructions, clearly stating the micro operations

that implements them

(i) BUN: Branch unconditionally (3)

(ii) BSA: Branch and save address. (9)

QUESTION FIVE (TWENTY MARKS)

Write the programs to evaluate the arithmetic statement

$$X = (A+B) * (C+D)$$

(i) Using a general-register –type computer with two-address instruction. (4)

(ii) Using a stack organized CPU with zero-address operation instruction. (4)

(b) Draw a block diagram showing the organization of a memory stack. (2)

(c) In some details write and explain the sequence of micro operations that implements the following operations in a stack memory.

(a) Push operation (5)

(b) Pop operation. (5)