KABARAK UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: **COMP 110**

COURSE TITLE: **INTRODUCTION TO COMPUTER SCIENCE**

STREAM: **Y1S1**

DAY: **MONDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **23/03/2009**

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

PLEASE TURN OVER

Question One: 30 Marks

a.) What are the benefits derive from the 'stored program concept? [2 marks]

b.) Do the following arithmetic: %1001 1010 - % 0010 110. Show the decimal values for these binary numbers in both 2's complement and unsigned data. Determine the values of the V and C bits and state if the answer is valid for each number system. [4marks]

c.) Many software programs are larger than the RAM available to store them. How then does the main memory get round this capacity problem? What role does Cache memory play in solving this limitation? [4 marks]

d.) Convert the decimal value –88.8 into single precision IEEE 754 floating-point format. Write your final answer in Hexadecimal format. [4 marks]

(e) Describe briefly why computers use 2's complement form for representation of negative binary numbers, rather than the "sign and magnitude" method we use for decimal. [5 marks]

e.) Convert the ASCII '2' into a suitable Hamming code that can detect and correct a single error. Use even parity. Write your final answer in Hexadecimal. [5 marks]

f.) $FED7 - $DCEF = $ [2 marks]

g.) Use K-maps to simplify the sum-of-products expansions [3 marks]

wxyz + wxyz' + wxy'z' + wx'yz + wx'y'z + wx'y'z' + w'xy'z + w'x'yz + w'x'y'z'

h.) Convert the Gray code 110101110 to binary [1 mark]

Question Two: 20 Marks

a.) What are the major functions of the Control Unit? [3 marks]

b.) What are the three basic purposes of primary storage? [3 marks]

c.) What is virtual memory? Why is it important to modern computers? [3 marks]

d.) One way to code decimal expansions using bits is to use the four bits of the binary expansion of each digit in the decimal expansion. For instance, 873 is encoded as 1000 0111 0011. This encoding of decimal is called a binary coded decimal (BCD) expansion. Since there are 16 blocks of four bits and only 10 decimal digits, there are six combinations of four bits that are not used to encode digits. Suppose that a circuit is to be built that produces an output of 1 if the decimal digit is 5 or greater and an output of 0 if the decimal digit is less than 5. How can this circuit be simply built using: -

(i) Sum-of-products [3.5 marks]

(ii) Product-of-sums. [3.5 marks]

(iii) Draw the corresponding logic circuits. (Hint: The Question involves don't care conditions) [1 marks]

e.) Perform the following system conversions:

i) Binary %1110 0111 to gray code

ii) %1101 1001 2's complement to decimal

iii) -17_{10} to 8 bit 2's complement [1 mark each total 3 marks]

Question Three: 20 Marks

a.) Computer performance is often described in terms of clock speed (usually in MHz or GHz)? What is clock speed? [1 mark]

b.) There are two main types of clock speed, latency and throughput. Briefly describe them. What is interrupt latency? [6 marks]

c.) When reducing Boolean expressions, we have used both Boolean algebra and Karnaugh Maps. [3 marks]

(i) Describe an advantage of using K-maps instead of Boolean algebra.

(ii) Describe an advantage of using Boolean algebra instead of K-maps.

(c) Use Boolean algebra to minimise the following expressions:

i) A+/AB

ii) AB+/AB

iii) (A+B)(A+C)

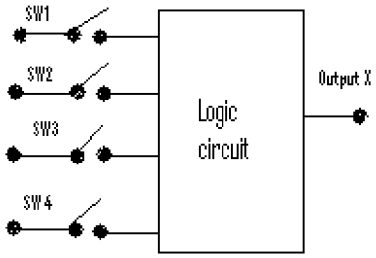
iv) A+AB [1.5 marks each total 6 marks]

(d) Convert IEEE 754 single precision format $BD180000 to decimal. [4 marks]

Question Four: 20 Marks

a.) What is duality? Why is it important in the designing of logic circuits? [4 marks]

b.) The figure below shows four switches that are part of the control circuitry in a copy machine. The switches are at various points along the path of the copy paper as the paper passes through the machine. Each switch is normally open, and as the paper passes over a switch, the switch closes. It is impossible for switches SW1 and SW4 to be closed at the same time. Design the logic circuit to produce a HIGH output whenever two or more switches are closed at the same time. Use K-mapping and take advantage of the don't care conditions. [5 marks]



c.) Use the laws of Boolean algebra to simplify the following expressions

i) X + X'Y + Y' + XX'Y + Y'X'Y

ii) Z(Y + Z)(X + Y + Z) [4 marks]

d.) What factors determine the performance of any given computer? [7 marks]

Question Five: 20 Marks

a.) Why are floating-point numbers used in scientific applications? How can you detect overflow? Is overflow a software or hardware problem? [4 marks]

b.) An 8-bit computer will perform the arithmetic operation **34 - 40**

i) What are the steps involved in the subtraction? [2 marks]

ii) Why do computers use this technique? [2 marks]

c.) Find the minimised sum of products expression for the following, using a K-map:

$f(\text{ABCD}) = \sum m(0,2,5,7,8,10)$, where (11,13,14,15) are don't cares [4 marks]

d.) What is the difference between parallel computing and neural computing? [2 marks]

e.) Convert $AED to decimal. [2 marks]

f.) Convert the decimal value –13.25 into single precision IEEE 754 floating-point format. Write your final answer in Hexadecimal format. [4 marks]