CS2021 ASSIGNMENT 5 (Due Date: Oct 15, 2021)

Instructions: This assignment consists of two sections. Section A has fifteen logical questions. Each question, has only one correct option. Section B has Questions has seven questions. You have to answer all of them.

SECTION A: Logical Questions

Instructions for Question 1 to Question 15: The questions below are logical questions. In each question, two statements X and Y are given. You have to identify from the following options what is their relation.

(a) Both statements are not true.

(b) Statement X is true. Statement Y is not true.

(c) Statement X is not true. Statement Y is true.

(d) Statement X is true. Statement Y is true. Statement X and Statement Y have no logical implication.

(e) Statement X is true. Statement Y is true. Statement X is a cause of Statement Y.

(f) Statement X is true. Statement Y is true. Statement Y is a cause of Statement X.

Question 1

X: In four hundreds years ago, there was no computer.
Y: In four hundreds years ago, there was no information system.

Question 2

X: There was no electricity in the sixteenth century.
Y: There was no communication network in the sixteenth century.

Question 3

X: Charles Babbage invented the Babbage difference machine in the nineteenth century.
Y: UK made the first commercial electronic computer in the middle of twentieth century.

Question 4

X: US made atomic bombs in the 1940s.
Y: US had at least one computer in the 1940s.

Question 5

X: Semiconductor transistor was invented in the 1940s.
Y: The first transistor computer was made in the 1950s.

Question 6

X: John Sum is a professor at the National Chung Hsing University.
Y: John Sum is a teacher teaching Introduction to Computer Science.

Question 7

X: John Sum is a professor in the Institute of Technology Management.
Y: National Chung Hsing University is a university.

Question 8

X: Microsoft Word is an application software running on MacOS only.
Y: Microsoft Word is an application software running on Windows only.

Question 9

X: Buyer can buy things on eBay.
Y: Buyers are the customers of eBay.

Question 10

X: The operation $A - B$, where both A and B are positive integers, can be realized by using full adders only.
Y: 2's complement is a number representation format for both positive and negative integers.

Question 11

X: All logical operations can be implemented by using NAND gates only.
Y: AND gate can be applied to implemented any logic gate.

Question 12

X: A full adder is a 3-input-2-output digital logic circuit.
Y: Full adders can only be applied to realize the addition of two positive integers only.

Question 13

X: Different CPUs have different architectures.
Y: Different CPUs provide different sets of instructions.

Question 14

X: Once a computer has been power off, the data in its RAM will be gone.
Y: Once an iPhone computer has been power off, the data in its RAM will be gone.

Question 15

X: Without electricity, Microsoft Word is unable to be running on a computer.
Y: Without electricity, it is unable to edit a report.

SECTION B: Descriptive Questions

Question 16

As introduced in the lecture, a text file is basically a file of a stream of characters in form of binary bits. Each character is encoded by 8 bits. Now, you keyed in the command "type temp01.txt" on the command prompt and see the following content.

```
C:\>type temp01.txt
J 1.
M 2.
C:\>
```

For another file "temp02.txt", you do the same thing and you see the following content.

```
C:\>type temp02.txt
J 1. M 2.
C:\>
```

(a) In file 'temp01.txt', what is the number of bytes being used for storing the content and what is the binary stream of it?

(b) In file 'temp02.txt', what is the number of bytes being used for storing the content and what is the binary stream of it?

Question 17

To store an image, it could be saved in different formats, like JPEG, BMP and PS format.

(a) State the full names of the above formats.

(b) Which format can maintain the highest resolution of an image?

(c) Describe why there are many format for storing an image?

Question 18

Implement the following logic gates or digital logic circuits using NAND gates only.

(a) AND gate.

(b) OR gate.

(c) XOR gate.

(d) Half adder.

To answer this question, you can simply draw the diagrams on a piece of paper. Then, you take a photo of the paper and paste it on your document. Beware of the file size!

Question 19

State the truth tables of the following logical operations.

(a) $Z = A\bar{B}$.

(b) $Z = A + \bar{B}$.

(c) $Z = A\bar{B} + \bar{A}B$.

(d) $Z = ABC$.

Question 20

(a) Convert the decimal number 2097 in 16-bit sign-magnitude integer number format.

(b) Convert the decimal number -2097 in 16-bit 2's complement integer number format.

(c) For a integer which is represented in sign-magnitude format, how do we identify if a number is a negative number?

(d) For a integer which is represented in 2's complement format, how do we identify if a number is a negative number?

Question 21

(a) What is the minimum integer that can be represented by the 8-bit 2's complement integer number format?

(b) What is the minimum integer that can be represented by the 8-bit sign-magnitude integer number format?

(c) What is the largest integer that can be represented by the 8-bit 2's complement integer number format?

(d) What is the largest integer that can be represented by the 8-bit sign-magnitude integer number format?

Question 22

Below is the table for the conversion of an Hexadecimal code to other codes.

Hexadecimal	Binary	Decimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

For a nonnegative integer represented in n-digit hexadecimal format, say

$$X_{16} = a_{n-1}a_{n-2}\cdots a_1a_0,$$

its decimal number can be obtained by the following formulae.

$$\begin{aligned} X_{10} &= a_{n-1}\times 16^{n-1} + a_{n-2}\times 16^{n-2} \\ &\quad + \cdots + a_1\times 16^1 + a_0\times 16^0. \end{aligned}$$

(a) What is the binary code for the hexadecimal number A8?

(b) What is the number of A8 in decimal format?

(c) What is the largest number of an n-digit hexadecimal number?

(d) Convert the decimal number 159 to the corresponding 8-bit unsigned binary number and then encode the binary number in hexadecimal format.