Introduction to Computer Science: Class Test II

October 16, 2020. 9:30 - 11:00

Instructions:

I. In this test paper, there are five sections.

II. **Section A** consists of ten MC questions (Question 1 to Question 10). Each question carries two marks. You have to answer all of them.

For each question in Section A, you will get '+2' marks if your answer is correct. If your answer is wrong, you will get '−2' marks. If you do not answer the question, you will get '0' mark.

$$\text{MC Score} = \begin{cases} +2 & \text{if the answer is correct,} \\ 0 & \text{if there is no answer,} \\ -2 & \text{if the answer is wrong.} \end{cases}$$

III. The questions in **Section B** (Question 11 to Question 14), **Section C** (Question 15 to Question 18) and **Section D** (Question 19 to Question 22) are descriptive questions. Each question carries 10 marks. You need to select and answer altogether **eight** questions from these three sections. *But, there is one restriction. For each section, you have to select and answer at least two and at most three questions. If you answer more than three questions in a section, the extra question(s) will not be scored.*

That is to say, (i) you can select three questions from Section B, three questions from Section C and two questions from Section D. (ii) You can select three questions from Section B, two questions from Section C and three questions from Section D. (iii) You can select two questions from Section B, three questions from Section C and three questions from Section D.

IV. **Section E is a bonus section**. There are ten MC questions in this section. Each question carries two marks. You are not compulsory to answer them if you believe that you could get a good score from the Section A to Section D.

As the questions in Section E are MC questions, the marking scheme is the same as the scheme for the questions in Section A.

$$\text{MC Score} = \begin{cases} +2 & \text{if the answer is correct,} \\ 0 & \text{if there is no answer,} \\ -2 & \text{if the answer is wrong.} \end{cases}$$

V. In the end, one might get the total score below zero or above 100. So, the final score is calculated by the following formulae.

$$\text{Final} = \max\{0, \min\{100, Normal+Bonus\}\}.$$

VI. Put down all your answers on the answer book. If one answer book is not enough for your writing, you can ask for more answer books.

Reminder: Beware of wrong spelling!

SECTION A: MC Questions

Instructions for Question 1 to Question 10: 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.

(g) Statement X is true. Statement Y is true. Statement Y is a cause of Statement X. Statement X is also the cause of the Statement Y. That is to say, Statement X is true if and only if Statement Y is true.

Question 1

X: Paper making technology was invented in the ancient China.
Y: The first electronic computer was invented in the ancient China.

Question 2

Y: UK made the first commercial computer in the middle of 20th century.
X: In UK, Charles Babbage built a mechanical computer called the difference machine in the 19th century.

Question 3

X: John von Neumann built the first electronic computer in US during the World War II and used it to design atomic bomb.
Y: Alan Turing found a method to break the encryption code in which the German army used it for sending radio messages during the World War II.

Question 4

X: Mouse was invented by a group of engineers in Xerox.
Y: Steve Job made use of mouse to develop graphical user interface for controlling the operating system of a Mackintosh personal computer.

Question 5

X: An App developer has to pay commission to Apple whenever his/her App has been purchased by a buyer over the Apple App Store.
Y: An iOS App developer is a customer of Apple.

Question 6

X: Every digital system can be implemented only by NAND gates.
Y: Every logic gate can be implemented only by NAND gates.

Question 7

X: Every digital system can be implemented only by AND gates.
Y: Every logic gate can be implemented only by AND gates.

Question 8

X: One can access the Internet if his/her mobile phone is configured to the following setting.

WiFi	ON
Bluetooth	OFF
Cellular	OFF
Personal Hotspot	OFF

Y: Each modern mobile phone has a WiFi connection circuit in it.

Question 9

X: With reference with the ASCII code, the character 'J' is represented by an 8-bit binary code.
Y: With reference with the ASCII code, a Chinese character is represented by an 8-bit binary code.

Question 10

X: The number of binary bits to represent a Thai character is the same as the number of binary bits to represent an Arabic character.
Y: The number of binary bits to represent a Japanese character is the same as the number of binary bits to represent a Korean character.

SECTION B

Question 11

(a) State the definition of an information system. [4 marks]

(b) State two information technologies that we can find in 400 years ago. [2 marks]

(c) State two possible social effects that could be brought up by using information systems in the industry? [4 marks]

Question 12

(a) As an ethical practice, what should you do if you have come across someone who is logging in an account? [3 marks]

(b) As an ethical practice, what should you do if you have come across someone who is reading his/her emails? [2 marks]

(c) In the lecture, professor has introduced a method how to set a secure password. Describe in detail steps how to set a secure password. [3 marks]

(d) Suppose that you would like to access a computer in a computer lab to edit a report. Happen to be, only one computer is available in the lab. But, it has been hanging up and no response to any input. Under such circumstance, what should you do? [2 marks]

Question 13

(a) What is the contribution of Alan Turing in the history of computer? [2 marks]

(b) What is the contribution of Alan Turing in the World War II? [2 marks]

(c) After World War II, Alan Turing applied a position in the University of Manchester. As the university had an electronic computer there, Alan Turing though that it could be possible for him to realize a computer to mimic human thinking. In the end, did Alan Turing make it real? [2 marks]

(d) What was the cause of his death? [2 marks]

(e) What is the nationality of Alan Turing? [2 marks]

Question 14

(a) In 1975, IBM introduced the first personal computer called IBM5100 to the market. However, IBM5100 failed to meet the market. What are the two reasons leading its failure to the market? [4 marks]

(b) When Macintosh was released to the market in 1984, a new feature had been added. The new feature led to a revolution in the use of a computer. Subsequently, tech giants like IBM and Microsoft have to follow and add this new feature in their future product. What is this new feature? [2 marks]

(c) What are the technological advancements, both in hardware and software, from the first generation electronic computers to the era of personal computers? [4 marks]

SECTION C

Question 15

(a) State two analog systems that we can find in a notebook computer. [2 marks]

(b) CISC and RISC are two design architectures for processing units. Usually, CPU is a CISC processor while GPU is a RISC processor. Give the full names of these two architectures. [2 marks]

(c) Compare CISC processor and RISC processor in terms of (i) the number of instructions in the set of instructions, (ii) the circuit complexity and (iii) the average processing time of an instruction. [3 marks]

(d) Apple A-series processor is designed as a system-on-chip processor. What is a system-on-chip processor? [2 marks]

(e) Apart from Apple A-series processor, give another exemplar processor which is also a system-on-chip processor. [1 mark]

Question 16

(a) Convert 10010101 to decimal. Note that this number is represented in 8-bit sign-magnitude integer format. [2 marks]

(b) Representing 118 in 16-bit sign-magnitude integer format. [2 marks]

(c) Representing 118 in 16-bit 2's compliment integer format. [2 marks]

(d) Representing -118 in 16-bit sign-magnitude integer format. [2 marks]

(e) Representing -118 in 16-bit 2's compliment integer format. [2 marks]

Question 17

In the lecture, it has been introduced six common logic gates which could be used for digital system implementation.

(a) State the six logic gates and their truth tables which have been introduced in the lecture materials [6 marks]

(b) In general sense, what electronic components are these logic gates made of? [1 marks]

(c) Design a NOT gate by using one NAND gate. [1 marks]

(d) Design an AND gate by using two NAND gates. [2 marks]

Question 18

(a) State three *families of operating systems* that you can find in desktop computers. [3 marks]

(b) State three *families of operating systems* that you can find in smartphones. [3 marks]

(c) Which *family of operating systems* is open source? [1 mark]

(d) If one has downloaded an open source software and enhanced its functions, is it possible to sell the enhanced version for profit? [1 marks]

(e) Give reason(s) for your answer in (d). [2 marks]

SECTION D

Question 19

To store a text document in memory, each character in the document has to be represented in binary code (equivalently format).

(a) How many bits a character is represented under such scheme? [2 marks]

(b) In this *de facto* coding scheme, what languages their characters can be represented? [2 marks]

(c) For Asian languages, like Chinese and Japanese, other coding schemes have been designed. For these coding schemes, how many bits a character is represented? [2 marks]

(d) In the ASCII code table, there are many strange characters like codes from number 128 to 159. Why do we need to have these characters? [2 marks]

(e) In the ASCII code table, what is the purpose to have the strange characters from code number 176 to code number 178? [2 marks]

Question 20

In accordance with the default format for character representation, convert the following sequences of characters in binary.

(a) `John.` [3 marks]

(b) `Sum.` [3 marks]

(c) `101` [2 marks]

(d) `1 0 1`
[2 marks]

The number of characters in (a) is five. The number of characters in (b) is four. The number of characters in (c) is three. The number of characters in (d) is five, in which two of them are 'space'.

Question 21

`johnsum.txt` is a text file located at the root directory `C:>`. By typing the command below, the content of the file is shown.

```
C:>type johnsum.txt
John Sum. 1 0 1.
C:>
```

(a) How many characters are stored in the file? [2 marks]

(b) What are the binary codes for the first four characters? [4 marks]

(c) What is the binary code for the last character? [2 marks]

(d) What is the binary code for the 10th character? [2 marks]

Question 22

`johnsum.txt` is a text file located at the root directory `C:>`. By typing the command below, the content of the file is shown.

```
C:>type johnsum.txt
John Sum.
1 0 1.
C:>
```

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(a) How many characters are stored in the file? [2 marks]

(b) What are the binary codes for the first four characters? [4 marks]

(c) What is the binary code for the last character? [2 marks]

(d) What is the binary code for the 10th character? [2 marks]

SECTION E: Bonus Questions

There are ten bonus questions in this section. Each question carries 2 marks. If you are confident that you have performed very good in the previous questions, you can skip the questions in this section.

Question 23

In US, which university designed and built the first electronic computer?

(a) MIT

(b) Harvard

(c) Stanford

(d) University of Pennsylvania

Question 24

Which of the following statements is TRUE?

(a) Without electricity, it is not possible to have an information system.

(b) Without computer, it is not possible to have an information system.

(c) Without computer network, it is not possible to have an information system.

(d) Decision making is not a function of an information system.

Question 25

Which of the following hardware is usually not included in a modern cell phone?

(a) CPU.

(b) RAM.

(c) Microphone.

(d) Cloud memory.

Question 26

What is the maximum number that can be represented by a 16-bit binary number which is in unsigned integer format?

(a) $2^{16} - 1$

(b) $2^{15} - 1$

(c) $1 - 2^{16}$

(d) $1 - 2^{15}$

Question 27

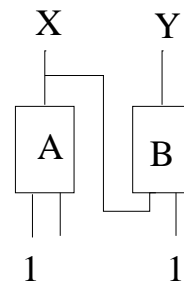A binary number is represented by the following 8-bit sign-magnitude fix-point format.

`sxxxxx.xx`

What is the minimum number that can be represented by using this format?

(a) 0.

(b) -255.

(c) -127.

(d) $-31\frac{3}{4}$.

Diagram for Questions 28-32

The following schematic diagram is for Question 28 to Question 32. It is a circuit consisting of two logic gates.

Question 28

What are the output values X and Y if A is an XOR gate, B is an NAND gate and the input (from left to right) is 111?

(a) $X = 0, Y = 0$.

(b) $X = 0, Y = 1$.

(c) $X = 1, Y = 0$.

(d) $X = 1, Y = 1$.

Question 29

What are the output values X and Y if A is an AND gate, B is an XOR gate and the input (from left to right) is 101?

(a) $X = 0, Y = 0$.

(b) $X = 0, Y = 1$.

(c) $X = 1, Y = 0$.

(d) $X = 1, Y = 1$.

Question 30

What are the output values X and Y if A is an NAND gate and B is an NAND gate and the input (from left to right) is 111?

(a) $X = 0, Y = 0$.

(b) $X = 0, Y = 1$.

(c) $X = 1, Y = 0$.

(d) $X = 1, Y = 1$.

Question 31

If the input (from left to right) is $1x1$, and the output $X = 1$ and $Y = 1$, ('x' means that the second input is unknown), which of the following combinations of gates will give this output?

(i) A is a OR gate and B is a OR gate.

(ii) A is a OR gate and B is an AND gate.

(iii) A is an AND gate and B is a OR gate.

Answer :

(a) (i) & (ii)

(b) (ii) & (iii)

(c) (i) & (iii)

(d) (i), (ii) and (iii)

Question 32

If the input (from left to right) is $1x1$, and the output $X = 1$ and $Y = 0$, ('x' means that the second input is unknown), which of the following combinations of gates will give this output?

(i) A is a OR gate and B is a XOR gate.

(ii) A is a OR gate and B is an NAND gate.

(iii) A is an NAND gate and B is a XOR gate.

Answer :

(a) (i) & (ii)

(b) (ii) & (iii)

(c) (i) & (iii)

(d) (i), (ii) and (iii)