Introduction to Computer Science: Class Test I

October 7, 2022. 9:15 - 10:45

Instructions: In this test paper, there are three parts of questions. Part I consists of 15 logical questions. Part II consists of 15 multiple choice questions. Part II consists of three long questions. For Part I and Part II, you need to answer all of them. For Part III, you only have to answer two of them.

Please write down your answers in the answer book by a blue ball pen, black ball pen or a pencil. However, pencil is not preferred as pencil writing could easily be erased. On the front page of your answer book, please remember to put on your name and student ID.

Dictionary, calculator, cell phone and computer are allowed to use during the exam. If you are waiting for an urgent call, please inform Professor John Sum before the examination starts.

Part I: Logical Questions

The questions in the part are logical questions. In each question, two statements **X** and **Y** are given. You need to select one of the following options for your answer.

(a) Both statements **X** and **Y** are not true.

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

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

(d) Both statements **X** and **Y** are true. But statements **X** and **Y** do not have any logical implication.

(e) Both statements **X** and **Y** are true. Statement **X** is a cause of statement **Y** but not in reverse. In other words, the happening of the event X is a necessary condition for the happening of the event Y.

(f) Both statements **X** and **Y** are true. Statement **Y** is a cause of statement **X** but not in reverse. In other words, the happening of the event Y is a necessary condition for the happening of the event X.

In this part, you need to answer all of them. Each question carries 2 marks.

Question 1

X: The instructor of this class is John Sum.
Y: The birthplace of John Sum is Hong Kong.

Answer: D.

Question 2

X: The email account for assignment submission is `pfsum@nchu.edu.tw`.
Y: The email account for applying sick leave to John Sum is `pfsum@nchu.edu.tw`.

Answer: C.

Question 3

X: Lecture notes of this class have been post on the course homepage.
Y: Student is able to download the soft copy of the textbook *Introduction to Computer Science* from the course homepage.

Answer: B.

Question 4

X: Student must provide a proof, like medical certificate, for his/her sick leave or absent for any reason.
Y: Any student who has skipped more than three lectures without proper reasons will get 'ZERO' score in this course.

Answer: D, E, F.

1

Question 5

X: Without notifying Professor John Sum in advance, student is not allowed to use computer, iPad or cell phone in the class.
Y: Student might use a computer, iPad or cell phone accessing social network application software or checking emails during the lecture.

Answer: B.

Question 6

X: Apple released her first personal computer with GUI controlled operating system in 1980s.
Y: Microsoft released her first GUI controlled operating system in 1980s.

Answer: E.

Question 7

X: Vacuum tube was invented by John Ambrose Fleming in 1900s.
Y: The first generation Lyon Electronic Office (LEO) computer was made of vacuum tubes.

Answer: E.

Question 8

X: Semiconductor transistor was invented in the late 1940s.
Y: Computers manufactured in the 1960s were made of semiconductor transistors.

Answer: E.

Question 9

X: A software which is able to be installed and executed in a Windows-based computer must be able to be installed and executed in a MasOS-based computer.
Y: Windows and MacOS are operating systems for personal computers.

Answer: C.

Question 10

X: The buyers who buy the Apps on the Google Play (respectively Apple Store) are the customers of Google (respectively Apple).
Y: Google Play (respectively Apple Store) is a platform for the APP developers to sell their Android (respectively iOS) Apps.

Answer: D.

Question 11

X: A telecommunication firm is unable to provide data service to her subscriber if its telecommunication network is not connected to the Internet.
Y: The backbone infrastructure of a telecommunication firm, i.e. the telecommunication network, has been connected to the Internet via some exchange machines.

Answer: C.

Question 12

X: A cell phone can connect to the Internet via WiFi only.
Y: A notebook computer can connect to the Internet via WiFi only.

Answer: A, C.

Question 13

X: In a computer, both addition (i.e. $A + B$) and subtraction (i.e. $A - B$), 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.

Answer: C.

Question 14

X: In US, her first electronic computer was made during the World War II.
Y: US scientists and engineers used a computer during the World War II for the design of atomic bombs.

Answer: C.

Question 15

X: In UK, Lyon made the world first electronic computer for commercial use.
Y: In US, Remington Rand made the world first electronic computer for commercial use.

Answer: D.

Part II: MC Questions

In this part, you need to answer all of them. Each question carries 2 marks.

Question 16

If your cell phone is unable to connect to the Internet, which of the following functions will be disabled?

(i) Voice assistant (like Siri).

(ii) iMessage.

(iii) Messages.

Answer: A.

(a) (i) and (ii) only.

(b) (ii) and (iii) only.

(c) (i) and (iii) only.

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

Question 17

Once you have been making a voice call to your friend via his/her telephone number, what will you see on the top left hand corner of your phone?

Answer: B.

(a) It shows 2G.

(b) It shows 3G.

(c) It shows 4G.

(d) It shows 5G.

Question 18

Once you have been making a LINE call to your friend, what will you see on the top left hand corner of your phone?

Answer: C.

(a) It shows 2G.

(b) It shows 3G.

(c) It shows 4G.

(d) It shows 5G.

Question 19

Which of the following statement(s) regarding MS WORD is(are) true?

(i) MS WORD is a word processing software.

(ii) MS WORD is able to check and correct any grammatical mistake.

(iii) MS WORD is able to check and correct any spelling mistake.

Answer: A.

(a) (i) only.

(b) (ii) only.

(c) (iii) only.

(d) (i) and (ii) only.

(e) (ii) and (iii) only.

(f) (i) and (iii) only.

(g) (i), (ii) and (iii).

Question 20

Which of the following software can be found in a Windows-based computer for editing a text document?

(i) MS WORD.

(ii) Wordpad.

(iii) Notepad.

Answer: G.

(a) (i) only.

(b) (ii) only.

(c) (iii) only.

(d) (i) and (ii) only.

(e) (ii) and (iii) only.

(f) (i) and (iii) only.

(g) (i), (ii) and (iii).

Question 21

Which of the following software will be non-functional if a computer has not been connected to the Internet?

(i) MS WORD.

(ii) Chrome.

(iii) LINE of PC.

Answer: E.

(a) (i) only.

(b) (ii) only.

(c) (iii) only.

(d) (i) and (ii) only.

(e) (ii) and (iii) only.

(f) (i) and (iii) only.

(g) (i), (ii) and (iii).

Question 22

Suppose your cell phone (with enough battery power) has been set to the following conditions but your cell phone is not able to access www.nchu.edu.tw. However, you can still make a phone call. Which of the following is likely the cause of this connection failure?

```
WiFi               ON
Bluetooth          OFF
Cellular           ON
Personal Hotspot   OFF
Carrier            ON
```

Answer: D.

(a) There is no available WiFi around.

(b) Personal Hotspot is OFF.

(c) Bluetooth is OFF.

(d) Web server www.nchu.edu.tw is down.

Question 23

Suppose your cell phone (with enough battery power) has been set to the following conditions.

```
WiFi               OFF
Bluetooth          OFF
Cellular           OFF
Personal Hotspot   OFF
Carrier            ON
```

What can you do with your cell phone?

Answer:

(i) Take photo.

(ii) Make a phone call.

(iii) Access Internet.

Answer: A.

(a) (i) and (ii) only.

(b) (ii) and (iii) only.

(c) (i) and (iii) only.

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

Question 24

Which of the following statements are true?

(i) To send a message to your friend via Facebook, you need to login a Facebook account.

(ii) To watch a video on Youtube, you need to login a Google account.

(iii) To upload a file onto a cloud platform, you need to login a user account.

Answer: F.

(a) (i) only.

(b) (ii) only.

(c) (iii) only.

(d) (i) and (ii) only.

(e) (ii) and (iii) only.

(f) (i) and (iii) only.
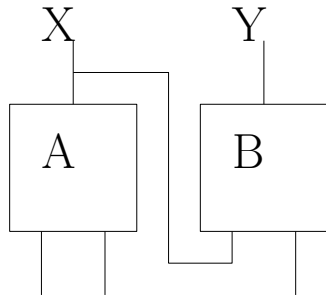
(g) (i), (ii) and (iii).

Figure 1: Simple logic circuit for Question 25 to Question 30.

Diagram for Questions 25-30

Figure 1 shows a simple digital logic circuit which consists of two logic gates only. The figure is used for answering Question 25 to Question 30.

Question 25

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

Answer: D.

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

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

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

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

Question 26

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

Answer: D.

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

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

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

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

Question 27

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?

Answer: B.

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

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

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

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

Question 28

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

Answer: C.

(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 NAND gate and B is an NAND gate and the input (from left to right) is 111?

Answer: B.

(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 OR gate, B is an AND gate and the input (from left to right) is $1x1$? Here, 'x' means that the second input is unknown.

Answer: D.

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

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

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

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

Part III: Long Questions

In this part, you only need to answer two questions from Question 31 to Question 33. Each question carries 20 marks.

Question 31

In this question, there are 10 sub-questions.

(a) State any two countries which had at least one computer for use during the World War II. [2 marks]

Answer: UK, US and Germany.

(b) After World War II, Alan Turing was involved in the design of a stored-program computer based on his conceptual model introduced in 1930s. What is the name of this computer? [2 marks]

Answer: Automatic Computing Engine (ACE).

(c) What was the cause of the death of Alan Turing in 1954? [2 marks]

Answer: Committing suicide.

(d) After WWII, John Mauchly and J. Presper Eckert in US started a venture on making commercial computers. However, people were skeptic on this. In the BBC documentary, two skeptical reasons have been mentioned. What are they? [4 marks]

Answer: (1) The machine was made out of large numbers of vacuum tubes also these tubes were prone to burning out. (2) The machines complexity to make a computer was not an easy task, it required an understanding of very advanced mathematics.

(e) John Mauchly and J. Presper Eckert named the computer to be made the UNIVAC. What is the full name of this machine? [2 marks]

Answer: Universal Automatic Computer (UNIVAC).

(f) In US, Eckert-Mauchly Computer was finally sold to Remington Rand. A new division under Remington Rand was created to continue the Eckert and Mauchly computer project. What is the name of this new division? [2 marks]

Answer: Eckert-Mauchy Division.

(g) What are the social effects of computers in factory and office automation? [2 marks]

Answer: (1) Computer was able to improve the productivity of a firm. (2) Many works were replaced by computer. So, many workers were lay-off.

(h) State the evolution of the methods of controlling an operating system from the fifth to the seventh generation of computers. [2 marks]

Answer: 5G: Text command. 6G: Text command and GUI-based command. 7G: Text command, GUI-based command and voice command.

(i) State the names of two conceptual models of computer which were proposed in the earlier 20th century. [2 marks]

Answer: Turing machine and von Neumann model.

(j) Today, almost all computers their architectures follow one of these conceptual models. Which one is it? [2 marks]

Answer: von Neumann model.

Question 32

In the lecture note about *information systems*, it is stated that an information system is a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization. The mission of an information system is to improve the performance of people in organizations through the use of information technologies.

(a) In accordance with the lecture notes on *Information Systems*, state (i) the definition of an information system and (ii) the mission of an information system. [4 marks]

Answer: An information system is a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization. The mission of an information system is to improve the performance of people in organizations through the use of information technologies.

(b) Imagine that you were living in 400 years ago. (i) State three information systems which could be found at that time, (ii) describe what were they used for and (iii) state who were the owners of these information systems. [12 marks]

Answer: In 400 years ago, information systems could be found. Here describes a few of them.

A merchant would need to have an *accounting information system* to manage the cash flow information. The information included, but not limited to, (i) the amount of payment in each transaction, (ii) the name of the payer (i.e. customer) who had not settled a transaction and the amount of the payment, (iii) the name of the payee (i.e. supplier) whose transaction had not been settled and the amount of the payment. The owner of the information system was clearly the merchant.

A city government would have a *census information system* to manage the personal information of every citizen living in the city. Just like any census information system of today, the information to be collected in the system included (i) the address of the family; (ii) the name, the age and the gender of each member in the family. The owner of the information system was clearly the city government.

Similarly, a city government would have a *taxation information system* to manage the tax payment information of every citizen living in the city. Clearly, the owner of this information system was the city government.

The imperial library (resp. imperial medical library) in the palace (resp. imperial academy of medicine) would have a *library information system* which facilitated a user to search for a book or a document in it. The owner of this information system was the emperor.

(c) State the information technologies which were likely used for the realization of (i) information collection, (ii) information processing, (iii) information storage and (iv) information distribution. [4 marks]

Answer: (i) For information collection, a manual worker would have to write down the information on a paper book. So, the technologies to support information collection are the writing technique, a hair pen and a book.

(ii) Information processing normally appeared in the *accounting information system*. A merchant would like to calculate the data like monthly profit. The key technology for information processing was thus the abacus.

(iii) In 400 years ago, the technologies for information storage were the paper account book and the cabinet for locking the account books.

(iv) For information distribution, it relied a lot on the technologies supporting the delivery of a message from one location to another. The process were realized by a human worker or an animal carrying the message to the destination location. There were three possible ways to accomplish this work. The first way was based on running or walking to the destination location. The second way was based on riding a horse to the destination location. The third way was to let a pigeon carry the message and fly to the destination location.

Question 33

You are given a set of eleven balls. All of them look the same. Nine balls are normal balls each weights 2000 grams and two balls are abnormal whose weights could be either 2002 grams or 1998 grams. Clearly, human is hardly to sense the weight difference. Now, the only tool for you is a pan balance. Describe in detail, step by step, how do you use the pan balance to find the abnormal balls. [20 marks]

Answer: The key idea of the algorithm is based on pairwise comparison. First of all, the balls are named as $B_1, B_2, \cdots, B_{11}$. For the first round, B_1 is compared with B_2 to B_{11}. Five results can be observed.

Case I: B_1 is normal.

2	3	4	5	6	7	8	9	10	11
$=$	$=$	$\neq$	$=$	$=$	$=$	$=$	$\neq$	$=$	$=$

7

Case II: B_1 is lighter and the other abnormal ball is lighter.

2	3	4	5	6	7	8	9	10	11
<	<	<	<	<	=	<	<	<	<

Case III: B_1 is lighter and the other abnormal ball is heavier.

2	3	4	5	6	7	8	9	10	11
<	<	<	<	<	<	<	<	<	<

Case IV: B_1 is heavier and the other abnormal ball is lighter.

2	3	4	5	6	7	8	9	10	11
>	>	>	>	>	>	>	>	>	>

Case V: B_1 is heavier and the other abnormal ball is heavier.

2	3	4	5	6	7	8	9	10	11
>	>	>	>	>	=	>	>	>	>

Therefore, we can identify if B_1 is a normal ball or an abnormal ball based on the number of = signs. If the number of = signs is 8, B_1 is normal. The abnormal balls are those with $\neq$ signs.

If the number of = signs is either 0 or 1, B_1 is an abnormal ball. Moreover, the weight of the other abnormal can be identified.

Case	Another abnormal ball
II	Lighter
III	Heavier
IV	Lighter
V	Heavier

For Case II to Case V, a second round of comparisons is needed. B_2 is compared with B_3 to B_{11}. Three results can be observed.

Case I: B_2 is a normal ball.

3	4	5	6	7	8	9	10	11
=	=	=	=	=	$\neq$	=	=	=

Case II: B_2 is a lighter ball.

3	4	5	6	7	8	9	10	11
<	<	<	<	<	<	<	<	<

Case II: B_2 is a heavier ball.

3	4	5	6	7	8	9	10	11
>	>	>	>	>	>	>	>	>

The solution for the solving the problem could thus be depicted in the following algorithm.

```
==========================================
Algorithm
==========================================
Step 1: Name the balls as B1 to B11.
Step 2.1: FOR N from 2 to 11,
          COMPARE B1 with BN,
          RECORD the result.
        END
Step 2.2: IF the no. of = signs is 8,
          the abnormal balls are those
          with unequal signs.
          STOP.
        ELSE the no. of unequal
          signs is larger than or
          equal to 9, B1 is abnormal
          ball and then GOTO Step 3.
        ENDIF
Step 3.1: FOR N from 3 to 11,
          COMPARE B2 with BN,
          RECORD the result.
        END
Step 3.2: IF the no. of = signs is 8,
          the abnormal ball is the one
          with unequal signs.
          STOP.
        ELSE the no. of unequal
          signs is 9, B2 is abnormal
          ball.
          STOP.
        ENDIF
==========================================
```