Introduction to Computer Science: Final Exam

January 14, 2022. 9:30 - 11:00

Name: _____

Student ID: _____

Instructions: This paper consists of 70 multiple choice questions in two sections. Section A consists of 40 questions. Each question carries ONE mark. Section B consists of 30 questions. Each question carries TWO marks. You need to answer all 70 questions. For each question, there is only ONE correct answer.

Some questions in the paper have an option 'None of the above.'. Let say, a question has five options, (a), (b), (c), (d) and (e). The option (e) is 'None of the above.'. If you have found that the options from (a) to (d) are not correct, you answer for this question should be 'e'.

Please circle your answer, or write down your answer on the left of the question, either by using a blue or black ball pen. Dictionary and calculator are allowed.

Please do not take away this paper. It has to be returned for marking.

Section A

For the Question 1 to Question 10, you need to select one of the following options for your answer.

(a) Both X and Y are false.

(b) X is true. Y is false.

(c) X is false. Y is true.

(d) Both X and Y are true. X and Y are two independent events.

(e) Both X and Y are true. X is a cause of Y.

(f) Both X and Y are true. Y is a cause of X.

(g) Both X and Y are true. Y is the cause of X and X is also the cause of Y.

Question 1

X: John Sum is a professor in NCHU.

Y: John Sum is a male.

Question 2

X: DevC is the only C compiler available for use.

Y: DevC is able to check logical error(s) in a C program.

Question 3

X: Today, a smart phone could have multiple CPU and multiple GPU in it.

Y: Today, semiconductor firms are able to manufacture multi-core (i.e. multiple CPU and multiple GPU in a single chip) chips.

Question 4

X: All executable programs their program names must be appended with an extension '.exe'.

Y: All document files their file names must not be appended with an extension '.exe'.

Question 5

X: Developer cannot sell any software for profit if the development of the software is based upon any open source program.

Y: Open source program is protected by general public licence (GPL).

Question 6

X: The HTML interpreter is able to interpret a Python program.

Y: HTML is an interpreted language.

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Question 7

X: File transfer protocol (FTP) is an application-layer protocol.

Y: FTP is embraced in the TCP/IP.

Question 8

X: Radio signal can be transmitted in the air (to support the communication within a WiFi or 3G/4G network) and in the space (to support the communication between the satellite and the earth station).

Y: A spacecraft can communicate directly with the earth station at any time and at any where in the outer space.

Question 9

X: Each CPU must have a control unit.

Y: Once an instruction has arrived the CPU, the control unit will decode the instruction and generate a sequence of micro-instructions (in the form electrical signals) to control the logical functions of the logic gates.

Question 10

X: Safari is a system software.

Y: Safari has an interpreter for interpreting a web page file.

Question 11

Which of the following countries had a computer during the WWII?

(i) Germany.

(ii) UK.

(iii) USA.

Answer:

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

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

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

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

Question 12

In the history of computer, Steve Jobs introduced at least three revolutionary products to the market. Which of the following statements about the revolutionary products are correct?

(i) Apple computer is the world first personal computer which is affordable for many families.

(ii) Macintosh is the first computer in the world with GUI for controlling the operating system.

(iii) iTune is the first Internet platform with a disruptive business model for song selling.

Answer:

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

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

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

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

Question 13

In a computer, which of the following device(s) has(have) to be connected to the clock circuit in the mother board for synchronization?

(i) Network card.

(ii) Hard disk.

(iii) RAM.

Answer:

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

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

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

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

(e) None of the above.

Question 14

If a processor is analogized to a factory, what are the appropriate mappings for (i) a register in a processor and (ii) the main memory?

Answer:

(a) (i) A register could be analogized to a worker in a factory. (ii) The main memory could be analogized to the working space in the factory.

(b) (i) A register could be analogized to a working space in a factory. (ii) The main memory could be analogized to the warehouse for storing final products.

(c) (i) A register could be analogized to a worker in a factory. (ii) The main memory could be analogized to the warehouse for storing final products.

(d) (i) A register could be analogized to a working space in a factory. (ii) The main memory could be analogized to a worker in the factory.

Question 15

Suppose you have subscribed the voice service and data service from a local telecom firm for your smart phone. The battery of the smart phone has been fully charged. Which of the following settings in you smart phone will let you send a LINE message to your friend at any time and any where?

(i) WiFi ON, Bluetooth OFF, Cellular Data OFF, Carrier ON and Hotspots OFF.

(ii) WiFi ON, Bluetooth OFF, Cellular Data OFF, Carrier OFF and Hotspots OFF.

(iii) WiFi ON, Bluetooth OFF, Cellular Data ON , Carrier ON and Hotspots OFF.

Answer:

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

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

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

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

(e) None of the above.

Question 16

Which of the following software are system software?

(i) Windows.

(ii) Windows Mobile.

(iii) Windows Server.

Answer:

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

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

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

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

Question 17

Which of the following software are application software?

(i) DevC.

(ii) Microsoft Word.

(iii) SPSS.

Answer:

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

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

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

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

Question 18

Which of the following software are executable files?

(i) DevC.

(ii) Microsoft Word.

(iii) SPSS.

Answer:

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

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

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

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

Question 19

Suppose a number is represented in 8-bit sign-magnitude fixed-point format as below.

`SXXX.XXXX`

Which of the following is the best representation of 0.125?

Answer:

(a) `00000000`

(b) `00000001`

(c) `00000010`

(d) `00000100`

(e) None of the above.

Question 20

Suppose a number is represented in 8-bit sign-magnitude fixed-point format as below.

`SXXX.XXXX`

Which of the following is the best representation of 0.1?

Answer:

(a) `00000000`

(b) `00000001`

(c) `00000010`

(d) `00000100`

(e) None of the above.

Question 21

Suppose a number is represented in 8-bit sign-magnitude fixed-point format as below.

`SXX.XXXXX`

Which of the following is the best representation of 0.1?

Answer:

(a) `00000000`

(b) `00000001`

(c) `00000010`

(d) `00000100`

(e) None of the above.

Question 22

Suppose a number is represented in 8-bit fixed-point format as below.

`SXX.XXXXX`

What is the absolute difference between the 10th and 11 largest numbers that can be represented?

Answer:

(a) 0.03125.

(b) 0.06250.

(c) 0.12500.

(d) 0.25000.

(e) None of the above.

Question 23

Suppose a number is represented in 8-bit sign-magnitude fixed-point format as below.

`SXX.XXXXX`

$M1$, $M2$ and $M3$ are three memory spaces for three numbers, in which $M1 = 0.1$ and $M2 = 5$. Which of the following is the bit pattern of $M3$, where $M3 = M1 \times M2$?

Answer:

(a) `00001010`

(b) `00001111`

(c) `00010000`

(d) `00010001`

(e) None of the above.

Question 24

Suppose a number is represented in 8-bit 2's-complement integer formate. What is the absolute difference between the number 00000000 and 11111111?

Answer:

(a) 0.

(b) 1.

(c) $2^7 - 1$.

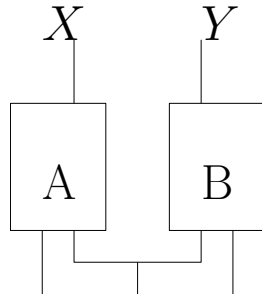(d) $2^8 - 1$.

(e) None of the above.

Question 25

Suppose a number is represented in 8-bit 2's-complement integer formate. What is the 2's-complement of 00000000?

Answer:

(a) 00000000.

(b) 10000000.

(c) 100000000.

(d) None of the above.

Diagram for Questions

The following schematic diagram is for Question 26 to Question 30. It is a circuit consisting of two logic gates.

Question 26

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.

(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 OR gate, B is an OR 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 28

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 29

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.

(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

Given a set of five balls which sizes are the same, namely $B1, B2$, $B3$, $B4$ and $B5$. There are three normal balls which weight 200 grams and two abnormal balls which weight either 199 grams or 201 grams. A pan balance is used for comparing the weights of $B1$ and BX, where $X = 2, 3, 4, 5$. Below is the results after the comparisons.

$B1$vs$B2$	$B1$vs$B3$	$B1$vs$B4$	$B1$vs$B5$
>	>	=	>

BX vs BY results $>$ meaning that BX is heavier than BY. From the results, which of the following conclusion(s) can be made?

(i) $B1$ and $B3$ are the abnormal balls.

(ii) $B1$ and $B4$ are the abnormal balls.

(iii) The abnormal balls weight 201 grams.

Answer:

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

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

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

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

(e) None of the above.

Question 32

Given a set of five balls which sizes are the same, namely $B1, B2$, $B3$, $B4$ and $B5$. There are three normal balls which weight 200 grams and two abnormal balls which weight either 199 grams or 201 grams. A pan balance is used for comparing the weights of $B1$ and BX, where $X = 2, 3, 4, 5$. Below is the results after the comparisons.

$B1$vs$B2$	$B1$vs$B3$	$B1$vs$B4$	$B1$vs$B5$
$>$	$=$	$=$	$<$

BXvsBY results $>$ meaning that BX is heavier than BY. From the results, which of the following conclusion(s) can be made?

(i) $B2$ and $B5$ are the abnormal balls.

(ii) $B2$ weights 199 grams and $B5$ weights 201 grams.

(iii) $B2$ weights 201 grams and $B5$ weights 199 grams.

Answer:

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

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

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

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

(e) None of the above.

Question 33

Given a set of nine balls which sizes are the same. There are six normal balls which weight 200 grams and three abnormal balls which weight either 199 grams or 201 grams. A pen balance is used as a tool to implement the Algorithm I. Its pseudo-code is listed in the Appendix. Which of the following statements about the algorithm are correct?

(i) Follow the algorithm, we can find out all three abnormal balls.

(ii) The maximum number of the usages of the pan balance is 21.

(iii) Follow the algorithm, we are able to figure out the weights of the abnormal balls.

Answer:

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

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

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

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

(e) None of the above.

Question 34

Given a set of nine balls which sizes are the same. There are six normal balls which weight 200 grams and three abnormal balls which weight either 199 grams or 201 grams. A pen balance is used as a tool to implement the Algorithm I. Its pseudo-code is listed in the Appendix. Given a set of nine balls, it is found that the program stops at Step S4. Which of the following statements are always correct?

(i) $B1$ is an abnormal ball.

(ii) $B2$ is a normal ball.

(iii) $B3$ is an abnormal ball.

Answer:

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

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

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

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

(e) None of the above.

Question 35

Refer to the artificial CPU and its commands in the Appendix. Note that the number is represented in 8-bit 2's complement format.

```
----------------
MOV IA M1
MOV IB M2
ADD IA IB
MOV IA OUT
MOV IB M3
SUB IA IB
MOV M4 OUT
----------------
```

What is the mathematical operation of the assembly program?

Answer:

(a) $M4 = M1 + M2 + M3$.

(b) $M4 = M1 + M2 - M3$.

(c) $M4 = M1 - M2 - M3$.

(d) $M4 = M1 - M2 + M3$.

Question 36

Refer to the artificial CPU and its commands in the Appendix. Note that the number is represented in 8-bit 2's complement format.

```
----------------
MOV IA M1
MOV IB M2
ADD IA IB
MOV IA OUT
MOV IB M3
SUB IA IB
MOV M4 OUT
----------------
```

Suppose the initial contents of M1, M2, M3 and M4 are given as below.

```
M1 = 00000011
M2 = 00000010
M3 = 00001000
M4 = 00000000
```

What is the content of M4 once the program is finished?

Answer:

(a) 10000010.

(b) 10000011.

(c) 11111101.

(d) 11111100.

Question 37

Refer to the artificial CPU and its commands in the Appendix. Which one of the following programs performs the function equivalent to that

$$M3 = M1 - M2.$$

(a)
```
----------------
MOV IA M2
MOV IB M1
SUB IA IB
MOV IA OUT
----------------
```

(b)
```
----------------
MOV IA M1
MOV IB M2
SUB IB IA
MOV IA OUT
----------------
```

(c)
```
----------------
MOV IA M2
MOV IB M1
SUB IB IA
MOV M3 OUT
----------------
```

(d)
```
----------------
MOV IA M1
MOV IB M2
SUB IB IA
MOV M3 OUT
----------------
```

(e) None of the above.

Question 38

Given that there are five memories M1, M2, M3, M4 and M5. Here is the program segment to instruct the circuit.

```
----------------
MOV IA M1
MOV IB M2
SHL IA 00000010
MOV IA OUT
SHL IB 00000100
MOV IB OUT
ADD IA IB
MOV M5 OUT
MOV IA M3
MOV IB M4
SHL IA 00000100
MOV IA OUT
ADD IA IB
MOV IA OUT
MOV IB M5
ADD IA IB
MOV M5 OUT
----------------
```

Which of the following mathematical equation is identical to the operation of the following program segment?

(a) $M5 = 2 \times (M1 + M2 + M3) + M4$.

(b) $M5 = 2 \times (M1 + 2 \times M2 + M3) + M4$

(c) $M5 = 2(\times M1 + 2 \times (M2 + M3)) + M4$.

(d) $M5 = M1 \times M2 + M3 \times M4$.

(e) None of the above.

Question 39

Which of the following language(s) its(their) characters are encoded in two-byte format?

(i) Chinese (Simplified).

(ii) Chinese (Traditional).

(iii) English.

Answers:

(a) None of them.

(b) (i) only.

(c) (ii) only.

(d) (iii) only.

(e) (i) and (ii) only.

(f) (ii) and (iii) only.

(g) (i) and (iii) only.

(h) All of them.

Question 40

What are the common causes of a bad sector?

(i) Accidental collision between the reader head and the magnetic disk in a hard disk.

(ii) Natural deterioration of the physical property of a hard disk.

(iii) Strong magnetic field appears around the hard disk.

Answers:

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

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

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

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

Section B

Question 41

Once a computer has been hanged up, the screen is on as usual but the computer has no response to the keyboard or mouse input. What are the common causes of a sudden computer hang-up?

(i) A background process has consumed too much memory space for working. For instance, the working memory required is much larger than the size of RAM.

(ii) The RAM has been accidentally burnt out.

(iii) The power cable has been accidentally unplugged.

Answers:

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

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

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

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

Question 42

In principle, which of the following items are considered as a program?

(i) A sequence of micro-instructions generated by the control unit for an instruction feeding to a CPU.

(ii) The machine codes of an executable file.

(iii) An operating system.

Answers:

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

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

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

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

Question 43

Which of the following statements are true?

(i) The bit rate (number of bit per second) of a data/message to be transmitted in a wireless network cannot exceed the frequency of the carrier wave.

(ii) One factor affecting the bit error rate is the channel noise.

(iii) In a 4G network, the formate of the bit pattern of an IP datagram together with the MAC addresses to be transmitted is defined in TCP/IP.

Answer:

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

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

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

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

Question 44

Which of the following wireless communication technologies have been implemented in both the smart phones (like iPhone and Android phone) and notebook computers?

(i) 3G/4G/5G.

(ii) WiFi.

(iii) Bluetooth.

Answer:

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

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

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

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

(e) None of the above.

Question 45

Which of the following statements about switching methods are correct?

(i) If two devices are logically connected via packet switching method, computational resources along a dedicated path will be reserved for the devices to ensure the quality of service.

(ii) If two devices are logically connected via circuit switching method, computational resources along a dedicated path will be reserved for the devices to ensure the quality of service.

(iii) To make a LINE call to your friend, a circuit will be established between your smart phone and your friend's smart phone.

Answer:

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

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

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

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

(e) None of the above.

Question 46

Which of the following program segments perform exactly the same thing as the program segment below?

```
for (i=0, i<5, i++)
  printf("*\n");
printf("Program end!");
```

(a) ```
i = 0;
while(i<=4)
{ printf("*\n"); i = i + 1;
printf("Program end!");
}
```

(b) ```
i = 1;
while(i<=5)
{ printf("*\n"); i = i + 1; }
printf("Program end!");
```

(c) ```
i = 0;
while(i<=4)
{printf("*\n"); i = i + 1; }
printf("Program end!\n");
```

(d) ```
i = 1;
while(i<=5)
{ printf("*\n"); i = i + 1; }
printf("Program end!");
```

(e) None of the above.

Question 47

If the following C program segment is executed, what will you see on the screen?

```
i=0;
While (i<=5)
{ printf("*"); i = i+1; }
printf("%d.", i+1);
```

(a) ```
*****5.
c:\>
```

(b) ```
*****6.
c:\>
```

(c) ```
******6.
c:\>
```

(d) ```
******7.
c:\>
```

(e) None of the above.

Question 48

In C language, $rand()$ is a command used for generating random number. Which of the following statements about this random number generator function is correct?

(a) Once the command "rand()%100" is executed, it will generate an random integer in between 1 to 100.

(b) Once the command "rand()%100" is executed, it will generate an random integer in between 0 to 99.

(c) Once the command "rand()%100" is executed, it will generate an random floating-point number in between 1 to 100.

(d) Once the command "rand()%100" is executed, it will generate an random floating-point number in between 0 to 99.

Question 49

Which of the following statements about comment delimiters "/*" and "*/" in C program are true?

(i) Whenever the compiler has encountered the comment delimiters, all the content inside the delimiters will be ignored.

(ii) Comment delimiters are used for adding the change history in a source code.

(iii) Adding comments in a source code is a way to help the programmer easily understand or recall the flow of the program.

Answer:

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

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

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

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

Question 50

What will you see on the console if the following program segment is executed?

```c
#include<stdio.h>
#include<stdlib.h>

main()
{
int i;

for(i=0; i<5; i++)
    printf("%d ", i%3);
printf("\n");
}
```

(a) 0 1 2 3 4
    c:\>

(b) 0 1 2 3 4

    c:\>

(c) 0 1 2 0 1
    c:\>

(d) 0 1 2 0 1

    c:\>

(e) None of the above.

Question 51

What will you see on the console if the following program segment is executed?

```c
#include<stdio.h>
#include<stdlib.h>

main()
{
int i;

for(i=5; i>0; i--)
    printf("%d ", i%3);
printf("\n");
}
```

(a) 1 2 0 1 2
    c:\>

(b) 1 2 0 1 2

    c:\>

(c) 2 1 0 2 1
    c:\>

(d) 2 1 0 2 1

    c:\>

(e) None of the above.

Question 52

Here is a program segment in the main program.

```c
srand(time(NULL));
for(i=0; i<5; i++)
{
    A[i] = rand();
    printf("%d ", A[i]);
}
```

Owing to compile the program successfully, which of the following header files have to be included?

 (i) `stdio.h`

(ii) `stdlib.h`

(iii) `time.h`

Answer:

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

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

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

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

(e) None of the above.

Question 53

Which of the following programs can be compiled successfully by a C compiler?

```c
(i) main()
    {
        int i = 1, j = 2, z;

        z = i+j;
        return z;
    }
```

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(ii)
```c
#include<stdio.h>

main()
{
    int i = 1, j = 2, z;

    z = i+j;
    printf("%d", z);

    return z;
}
```

(iii)
```c
#include<stdio.h>

main()
{
    int i = 1;
    int j = 2;

    z = i+j;
    return z;
}
```

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

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

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

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

Question 54

Refer to Program A. What is the content of "argv[1]" if the following command is typed?

```
c:\>winnerloser w 2 3 8 4
```

In the following, the quotation 'abcdefg' is referred to a string of characters abcdefg.

(a) 'winnerloser'.

(b) 'w 2 3 8 4'.

(c) 'w'.

(d) '2'.

Question 55

Refer to Program A. What is "atoi()" used for?

(a) To convert the character string argv[2] to an integer number.

(b) To convert the character string argv[2] to an array of single digit integer numbers.

(c) To convert the character string argv[2] to a floating point number.

(d) To convert the character string argv[2] to an array of single digit floating point numbers.

(e) None of the above.

Question 56

Refer to Program A. What will you see if the following command is typed?

```
c:\>winnerloser w 2 3 8 4 7 9 11 2 1 33
```

(a) `The value of the 2 winner is 11.`
    `c:\>`

(b) `The value of the 3 winner is 9.`
    `c:\>`

(c) `The value of the 2 looser is 2.`
    `c:\>`

(d) `The value of the 3 looser is 2.`
    `c:\>`

(e) None of the above.

Question 57

Refer to Program A. What will you see if the following command is typed?

```
c:\>winnerloser l 2 3 8 4 7 9 11 2 1 33
```

(a) `The value of the 2 winner is 11.`
    `c:\>`

(b) `The value of the 3 winner is 9.`
    `c:\>`

(c) `The value of the 2 looser is 2.`
    `c:\>`

(d) `The value of the 3 looser is 2.`
    `c:\>`

(e) None of the above.

Question 58

Refer to Program A. What will you see if the following command is typed?

```
c:\>winnerloser s 2 3 8 4 7 9 11 2 1 33
```

(a) The value of the 2 winner is 11.
    c:\>

(b) The value of the 3 winner is 9.
    c:\>

(c) The value of the 2 looser is 2.
    c:\>

(d) The value of the 3 looser is 2.
    c:\>

(e) None of the above.

Question 59

Refer to Program A. What will you see if the following command is typed?

```
c:\>winnerloser s 7 2 8 9 11 2 1
```

(a) Something wrong in your inputs.
    c:\>

(b) The position 7 is larger than 6.
    c:\>

(c) Something wrong in your inputs.
    The position 7 is larger than 6.
    c:\>

(d) The position 7 is larger than 6.
    Something wrong in your inputs.
    c:\>

(e) None of the above.

Question 60

Refer to Program A. What will you see if the following command is typed?

```
c:\>winnerloser s 6 3 2 8 9 11 2 1
```

(a) Something wrong in your inputs.
    c:\>

(b) The position 7 is larger than 6.
    c:\>

(c) Something wrong in your inputs.
    The position 7 is larger than 6.
    c:\>

(d) The position 7 is larger than 6.
    Something wrong in your inputs.
    c:\>

(e) None of the above.

Question 61

With reference to the simple processor as shown in the Appendix, Figure 1, suppose that the registers are preset as $RA = 1$, $RB = 1$, $RZ = 0$, $R1 = R2 = R3 = R4 = 0$. What will be the contents of the registers RA and RB after the following micro-instructions (S1, S2, S3 and S4) have been executed?

S1: $S_1 = S_8 = 1$. The control signals to other connectors are set to 0. The signals to all two-way switches are set to 00.

S2: $S_{14} = 01$. $S_{12} = S_{15} = 10$. The control signals to all connectors are set to 0. The signals to other two-way switches are set to 00.

S3: $S_2 = S_5 = S_9 = 1$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

S4: $S_{12} = 10$. $S_{14} = 01$. $S_{16} = 10$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

Answer :

(a) $RA = 0, RB = 0$.

(b) $RA = 0, RB = 1$.

(c) $RA = 1, RB = 0$.

(d) $RA = 1, RB = 1$.

Question 62

With reference to the simple processor as shown in the Appendix, Figure 1, suppose that the registers are preset as $RA = 1$, $RB = 0$, $RZ = 0$, $R1 = R2 = R3 = R4 = 0$. What will be the contents of the registers $R1$ and $R2$ after the following micro-instructions (S1, S2, S3 and S4) have been executed?

S1: $S_1 = S_8 = 1$. The control signals to other connectors are set to 0. The signals to all two-way switches are set to 00.

S2: $S_{14} = 01$. $S_{12} = S_{15} = 10$. The control signals to all connectors are set to 0. The signals to other two-way switches are set to 00.

S3: $S_2 = S_5 = S_9 = 1$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

S4: $S_{12} = 10$. $S_{14} = 01$. $S_{16} = 10$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

Answer :

(a) $R1 = 0, R2 = 0$.

(b) $R1 = 0, R2 = 1$.

(c) $R1 = 1, R2 = 0$.

(d) $R1 = 1, R2 = 1$.

Question 63

With reference to the simple processor as shown in the Appendix, Figure 1, suppose that the registers are preset as $RA = 0$, $RB = 1$, $RZ = 0$, $R1 = R2 = R3 = R4 = 0$. What will be the contents of the registers $R3$ and $R4$ after the following micro-instructions (S1, S2, S3 and S4) have been executed?

S1: $S_1 = S_8 = 1$. The control signals to other connectors are set to 0. The signals to all two-way switches are set to 00.

S2: $S_{14} = 01$. $S_{12} = S_{15} = 10$. The control signals to all connectors are set to 0. The signals to other two-way switches are set to 00.

S3: $S_2 = S_5 = S_9 = 1$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

S4: $S_{12} = 10$. $S_{14} = 01$. $S_{16} = 10$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

Answer :

(a) $R3 = 0, R4 = 0$.

(b) $R3 = 0, R4 = 1$.

(c) $R3 = 1, R4 = 0$.

(d) $R3 = 1, R4 = 1$.

Question 64

With reference to the simple processor as shown in the Appendix, Figure 1, it is assumed that the data in the memory locations $M1$ and $M2$ have already been copied to the registers RA and RB. What will be the logical operation once the following micro-instructions have been executed?

S1: $S_{12} = 01$ and $S_{15} = 10$. The control signals to other connectors are set to 0. The signals to all two-way switches are set to 00.

S2: $S_{12} = 10$ and $S_{13} = 01$. The control signals to other connectors are set to 0. The signals to all two-way switches are set to 00.

S3: $S_1 = S_8 = 1$. The control signals to other connectors are set to 0. The signals to all two-way switches are set to 00.

S4: $S_{12} = 10$, $S_{14} = 01$ and $S_{16} = 10$. The control signals to all connectors are set to 0. The signals to other two-way switches are set to 00.

S5: $S_{13} = 10$ and $S_{15} = 01$. The control signals to all connectors are set to 0. The signals to other two-way switches are set to 00.

S6: $S_2 = S_5 = S_9 = 1$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

S7: $S_{12} = 10$, $S_{14} = 01$ and $S_{15} = 10$. The control signals to other connectors are set to 0. The signals to other two-way switches are set to 00.

What of the following instruction have been executed?

Answer :

(a) $R1 = (\neg RA)RB$ and $R2 = \neg RA$.

(b) $R1 = RA(\neg RB)$ and $R2 = \neg RA$.

(c) $R1 = (\neg RA)RB$ and $R2 = \neg RB$.

(d) $R1 = RA(\neg RB)$ and $R2 = \neg RB$.

(e) None of the above.

Question 65

With reference to the simple processor as shown in the Appendix, Figure 1, which of the following micro-program(s) can perform the logical operation.

$$Z = \neg A \oplus \neg B,$$

where $\neg A$ refers to logical NOT A.

(i) 7-Step micro-program.

S1: $S_1 = S_8 = 1$. Other connectors and switches are set to 'Disconnection' mode.

S2: $S_{14} = 01$ and $S_{15} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S3: $S_{13} = 01$ and $S_{12} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S4: $S_1 = S_8 = 1$. Other connectors and switches are set to 'Disconnection' mode.

S5: $S_{14} = 01$ and $S_{13} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S6: $S_{15} = 01$ and $S_{12} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S7: $S_4 = S_7 = S_{11} = 1$. Other connectors and switches are set to 'Disconnection' mode.

(ii) 8-Step micro-program.

S1: $S_1 = S_8 = 1$. Other connectors and switches are set to 'Disconnection' mode.

S2: $S_{14} = 01$ and $S_{16} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S3: $S_{13} = 01$ and $S_{12} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S4: $S_1 = S_8 = 1$. Other connectors and switches are set to 'Disconnection' mode.

S5: $S_{14} = 01$ and $S_{13} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S6: $S_{16} = 01$ and $S_{12} = 10$. Other connectors and switches are set to 'Disconnection' mode.

S7: $S_4 = S_7 = S_{11} = 1$. Other connectors and switches are set to 'Disconnection' mode.

S8: $S_{14} = 01$ and $S_{15} = 10$. Other connectors and switches are set to 'Disconnection' mode.

(iii) One-step micro-program.

S1: $S_4 = S_7 = S_{11} = 1$. Other connectors and switches are set to 'Disconnection' mode.

Answer:

(a) (i) and (ii).

(b) (ii) and (iii).

(c) (i) and (iii).

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

(e) None of the above.

Question 66

Which of the followings is the correct structure of a HTML file?

(a) ```
<meta> ... </meta>
<body>
<html> ... </html>
</body>
```

(b) ```
<body>
<meta> ... </meta>
<html> ... </html>
</body>
```

(c) ```
<html>
<meta> ... </meta>
<body> ... </body>
</html>
```

(d)
```
<html>
<body>
<meta> ... </meta>
...
</body>
</html>
```

## Question 67

If one would like to highlight the name of a book (say "Computer Science") in italic, which of the following tag should be used?

(a) `<b>Computer Science</b>`

(b) `<a>Computer Science</a>`

(c) `<p>Computer Science</p>`

(d) `<i>Computer Science</i>`

## Question 68

In the source code of a webpage, there is a segment looking like this:

```
<ol>
<li> PhD CSE CUHK
<li> MPhil CSE CUHK
<li> BENG EE PolyU
</ol>
```

Once this webpage is browsed, what will you see?

(a)
```
a. PhD CSE CUHK
b. MPhil CSE CUHK
c. BENG EE PolyU
```

(b)
```
1. PhD CSE CUHK
2. MPhil CSE CUHK
3. BENG EE PolyU
```

(c)
```
o PhD CSE CUHK
o MPhil CSE CUHK
o BENG EE PolyU
```

(d)
```
- PhD CSE CUHK
- MPhil CSE CUHK
- BENG EE PolyU
```

(e) None of the above.

Question 69

In building a webpage, we can use the anchor tag

`<a href="...">...</a>`

to link to a URL. Which of the following files are allowable for this anchor tag to link to?

(a) Image file

(b) Video file

(c) Homepage

(d) All of them.

Question 70

Which of the following codes is in correct format?

(a) `<B><I>Computer Science</B></I>`

(b) `<B><I>Computer Science<B><I>`

(c) `<B><I>Computer Science</I></B>`

(d) `<B><I>Computer Science<I><B>`

(e) None of the above.

APPENDIX

In this appendix, it includes the information about (i) the artificial processor, (ii) (ii) the artificial CPU and (iii) the source codes of programs. Please read them carefully!

A. Processor with 4 Logic Gates

An artificial processor, with a sector of four logic gates and a sector of four registers, is shown in Figure 1. Each register is associated with a two-way switch. The signals to be fed to the switch and the corresponding actions are depicted in the following table.

S_i	Action
00	Disconnect.
01	Read from register.
10	Write to register.

For each connector, its control signal is either '0' (for disconnection) and '1' (for connection).

$$\text{Connection} = \begin{cases} \text{Connect} & \text{if } S_i = 1, \\ \text{Disconnect} & \text{if } S_i = 0. \end{cases}$$

Two-Way Switches: Disconnected (00); Down (01), Up (10).

$(S_{12}, S_{13}, S_{14}, S_{15}, S_{16}, S_{17}, S_{18})$

Connectors: Disconnected (0), Connected (1).

$(S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_9, S_{10}, S_{11})$

Figure 1: A processor with four logic gates. Switches S_1 to S_{11} are simple switches (i.e. connectors). S_{12} to S_{18} are two-way switches.

B. Processor with a NAND Gate

Figure 2 shows a simple processor with single NAND gate inside. Switches S_1, S_2 and S_3 are simple switches (i.e. connectors). S_{12}, S_{13} and S_{14} are two-way switches. The signals sending to $A1$, $A2$ and R/W together with the corresponding actions are depicted in the following table.

$A1$	$A2$	R/W	Action
0	0	01	Read data from $R1$
0	1	01	Read data from $R2$
1	0	01	Read data from $R3$
1	1	01	Read data from $R4$
0	0	10	Write data to $R1$
0	1	10	Write data to $R2$
1	0	10	Write data to $R3$
1	1	10	Write data to $R4$
x	x	00	Disconnection

Figure 2: A processor with single NAND gate.

C. Artificial CPU

Below is a simple circuit. It consists of a **memory** with 16 memory spaces (from M1 to M16), an **ALU block**, 2 **input registers** (IA and IB) and one **output register** (OUT). M1 to M16, IA, IB and OUT are all 8 bits long. Numbers are represented in *2's compliment* format.

ADD/SUB

Memory

Y	Meaning
10000000	(Shift 7 bits)
01000000	(Shift 6 bits)
00100000	(Shift 5 bits)
00010000	(Shift 4 bits)
00001000	(Shift 3 bits)
00000100	(Shift 2 bits)
00000010	(Shift 1 bits)
00000001	(No shift)

Eleven commands (MOV, ADD, SUB, MUL, DIV, CMP, SHL, SHR, DEF, MSK and IF) are provided for instructing the above circuit. The syntax and the descriptions of these commands are depicted in Table 1.

Table 1: Commands for using the CPU.

Syntax	Description
MOV X Y	Copy the content of Y to X
ADD X Y	$OUT = X + Y$.
SUB X Y	$OUT = X - Y$.
MUL X Y	$OUT = X \times Y$.
DIV X Y	$OUT = X/Y$.
CMP X Y	$OUT = b_1 b_2 b_3 b_4 b_5 b_6 b_7 b_8$.
	$b_i = 0$ if $X_i = Y_i$.
	$b_i = 1$ if $X_i \neq Y_i$.
SHL X Y	OUT is the content of X
	shifting left Y bits.
SHR X Y	OUT is the content of X
	shifting right Y bits.
DEF X N	Define X as the number N.
MSK X M	Mask the value of X by M.
IF ELSE	Condition statement.

D. Notes on CPU Commands

1. For the "CMP" command, if $X = 0110$ and $Y = 1101$, $OUT = 1011$.

2. For "SHL" and "SHR" commands, the content of Y can only be one of the following.

For example, if

$$X = 00011000, Y = 00000100,$$

the OUT of "SHL X Y" is 01100000 and the OUT of "SHR X Y" is 00000110.

3. For the "DEF" command, N must be a number in *decimal* form. X can only be a memory location. "DEF" command is not applicable for assigning values to a register. It is used to assign a value to a memory location. For example, "DEF M1 12" means that memory location $M1$ will be assigned with a value 12. Therefore, $M1 = 00001100$.

4. For the "MSK" command, it is used for masking a register (either IA or IB) by the mask M (in binary). The mask must be 8 bits long.

   Suppose that the content of IA and M are defined as follows :

   $$IA = 01001001, M = 11110000.$$

   Then, the output OUT will be "01000000". The last four bits are masked. Here is an example.

   ```
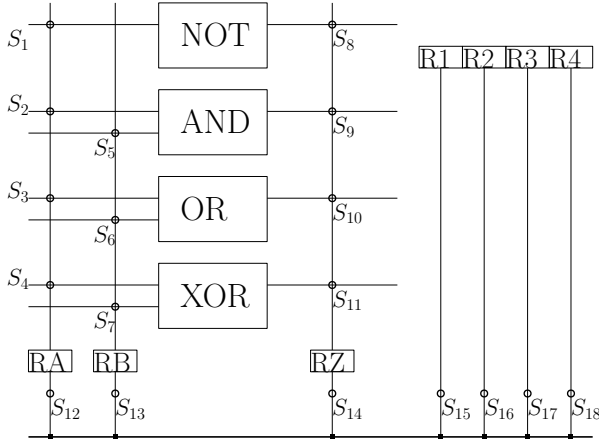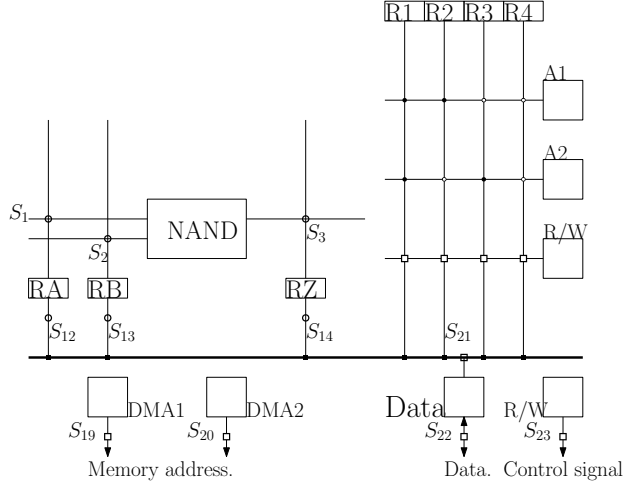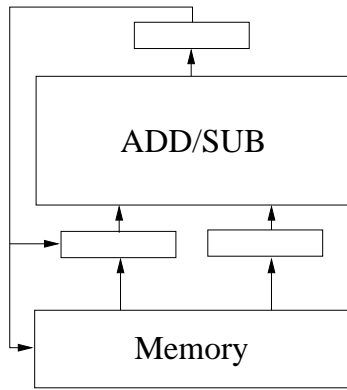   ------------------------
   DEF M1 45
   MOV IA M1
   MSK IA 00001111
   MOV M2 OUT
   ------------------------
   ```

   Initially, $M1$ is assigned with value 45. In binary form, the content reads "00101101". Thus, the output OUT is "00001101".

5. The "IF-ELSE" command is an advanced level command. It is for conditional statement. Once it is executed, the CPU will

performs multiple steps in order to make it works. You do not need to know the detail how it works. In term of its usage, it is simple. Here is an example.

```
------------------------
DEF M1 1
DEF M2 2
DEF M3 1

MOV IA M1
IF IA == 0
    MOV IA M2
    MOV IB M3
    ADD IA IB
    MOV M4 OUT
ELSE
    MOV IA M1
    ADD IB M2
    MOV M4 OUT
ENDIF
------------------------
```

Command "IF" checks if the content of IA is identical to "0". If it is, it will perform $M2+M3$ and output the result to $M4$. Otherwise, it will perform $M1+M2$ and output the result to $M4$.

```
------------------------
DEF M1 1
DEF M2 2
DEF M3 1

MOV IA M1
IF IA == 0
    MOV IA M2
    MOV IB M3
    ADD IA IB
    MOV M4 OUT
ENDIF
------------------------
```

In this example, the CPU performs $M2 + M3$ only if IA is zero. Otherwise, it performs nothing.

6. For the "IF-ELSE" command, the following conditions are allowed for you to define. Here NUM must be stated in decimal form but not in binary.

```
------------------------
IA == NUM
IA > NUM
IA >= NUM
IA < NUM
IA <= NUM
------------------------
```

E. Algorithm I

```
S1: FOR N = 2 to 9,
        Weight B1 and BN.
        Record the results.
    END

S2: IF the number of '=' sign is five,
        the balls with unequal signs are abnormal. STOP.
    ELSE
        B1 is abnormal. GOTO Step S3.
    ENDIF

S3: FOR N = 3 to 9,
        Weight B2 and BN.
        Record the results.
    END

S4: IF the number of '=' sign is four,
        the balls with unequal signs are abnormal. STOP.
    ELSE
        B2 is abnormal. GOTO Step S5.
    ENDIF

S5: FOR N = 4 to 9,
        Weight B3 and BN.
        Record the results.
    END

S6: IF the number of '=' sign is three,
        the balls with unequal signs are abnormal. STOP.
    ELSE
        B3 is abnormal. STOP.
    ENDIF
```

F. Program A

The filename of the following program is "winnerloser.cpp".

```cpp
/***************************************************************************
winnerloser.cpp
***************************************************************************/
#include<stdio.h>
#include<stdlib.h>

main(int argc, char *argv[])
{
    int A[256]; /* Define integer array. */
    int i,j; /* Define indices. */
    int tmp; /* Define dummy variable for sorting. */
    char Opt = 'c';
    int SNUM, POS;

    /* Step 1: Read input from the command line. */
    SNUM = argc - 3;
    Opt = argv[1][0];
    POS = atoi(argv[2]);

    if (POS <= SNUM)
    {
      if((Opt == 'w')||(Opt == 'l'))
      {
        for(i = 0; i<SNUM; i++)
            A[i] = atoi(argv[i+3]);

        /* Step 2: Sorting the numbers */
        if(Opt == 'l')
        {
          for(i=0; i<SNUM-1; i++)
          for(j=0; j<SNUM-i-1; j++)
          {
                if(A[j] > A[j+1])
                {
                tmp = A[j];
                A[j] = A[j+1];
                A[j+1] = tmp;
                }
          }
          printf("The value of the %d loser is %d.", POS, A[POS-1]);
        }
        if(Opt == 'w')
        {
          for(i=0; i<SNUM-1; i++)
          for(j=0; j<SNUM-i-1; j++)
          {
                if(A[j] < A[j+1])
                {
                tmp = A[j];
                A[j] = A[j+1];
                A[j+1] = tmp;
                }
          }
          printf("The value of the %d winner is %d.", POS, A[POS-1]);
        }
```

```
    }
    else
        printf("Something wrong in your inputs.");
  }
  else
      printf("The position %d is larger than %d.", POS, SNUM);
}
```