Introduction to Computer Science: Final Exam

June 19, 2020. 14:30 - 16:00

Name: _____

Student ID: _____

Instructions: This paper consists of 50 multiple choice questions. You have to answer all of them. Each carries two marks. Each question has only one correct option. Please put down the answer next to the question number. The information regarding the artificial CPU is put in the end of the paper.

Reminder: Read each question and its options carefully. Beware of careless mistake!

Question 1 – Question 10: You need to select one of the following options for your answer.

(a) Both X and Y are false.

(b) X is false. Y is true.

(c) X is ture. Y is false.

(d) Both X and Y are true. But X and Y have no logical implication.

(e) Both X and Y are true. X is the cause of Y, i.e. $X \rightarrow Y$.

(f) Both X and Y are true. Y is the cause of X, i.e. $Y \rightarrow X$.

Question 1

X: US is leading the worldwide computer industry today.

Y: US made the world first computer for commercial use.

Question 2

X: The first generation Lyon Electronic Office (LEO) computer was made of vacuum tubes.

Y: Vacuum tube was invented in 1800s.

Question 3

X: NASA was able to launch Apollo project and landed the first man on the moon in 1960s.

Y: Microprocessor was invented in the 1940s by a group of scientists in Bell Lab.

Question 4

X: Different processors might have different design architectures.

Y: Instruction sets provided by different processors could be different.

Question 5

X: It is not possible to run Safari in a MacOS machine.

Y: Safari is a browser developed for Windows operating systems.

Question 6

X: Mouse was co-invented by Xerox and Apple.

Y: Apple released the first personal computer with graphical user interface (GUI) for commanding the operating system.

Question 7

X: Logic gate did not appear in the early 20 century.

Y: There was no computer in the early 20 century.

Question 8

X: NOT, AND, OR, NOR and XOR gates can be implemented by NAND gates only.

Y: Any digital logic circuit can be implemented by NAND gates only.

Question 9

X: CSMA/CA is the only medium access control (MAC) protocol being used in the Internet.

Y: CSMA/CA is being used in wireless data communication.

Question 10

X: We can use an iPhone to browse a homepage and watch YouTube video at the same time.

Y: Android is designed to handle multitasking.

Question 11

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

(i) French.

(ii) German.

(iii) Japanese.

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 12

From the perspective of client-server operation mode, the relation between an application software and operating system could be considered as a client and a server. Which of the following systems are designed in client-server operation mode?

(i) Credit card system.

(ii) Transportation system.

(iii) Internet.

Answers:

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

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

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

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

Question 13

What are the common causes of a bad sector?

(i) Mechanical impact on 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).

Question 14

To facilitate the storage and retrieval of a file from the memory, a file allocation table (FAT) has to be maintained by the operating system. Which of the following information are maintained in the FAT?

(i) File name.

(ii) Ending memory location of the file.

(iii) Starting memory location of the file.

Answers:

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

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

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

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

Question 15

Which of the following factor(s) will determine the *speed* of a computer?

(i) Frequency of the clock signal, like 4.7GHz and 5.1GHz.

(ii) Design of the micro-instructions for an instruction.

(iii) Architectural design of a processor.

Answers:

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

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

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

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

Question 16

Which of the following processing unit is responsible to execute the tasks for the operating system?

Answers:

(a) Graphical processing unit (GPU).

(b) Operating processing unit (OPU).

(c) Central processing unit (CPU).

(d) System processing unit (SPU).

(e) None of the above.

Question 17

Which of the following programming language(s) is(are) interpreted language?

(i) Matlab programming language.

(ii) SPSS programming language.

(iii) SAS programming language.

Answers:

(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 has an interpreter inside?

(i) iOS.

(ii) MacOS.

(iii) Chrome.

Answers:

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

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

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

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

Question 19

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

(i) The 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 20

Which of the following statement about the interaction between an application software and the operating system is *False*?

(a) Once an application software has a request for an operating system, it sends a request message on the service queue of the operating system.

(b) Once the operating system has completed a request, it sends the result message on the receiving queue of the application software.

(c) Normally, an application software has no right to instruct the operating system to change the priority of its request.

(d) Normally, an operating system does not change the priority of a request from any application software.

(e) Normally, an operating system will serve the requests in *first-come-first-serve* basis.

(f) None of them is false.

Question 21

How does an application software know that the service request to an operating system has completed?

(a) The application software from time to time will send a message to the operating system checking for the progress.

(b) The application software from time to time will check from its queue seeing if there is anything there.

(c) The operating system from time to time will send a message to the application software informing the progress.

(d) The operating system from time to time will check from its queue seeing if there is any *checking-for-progress* message coming.

(e) None of the above.

Question 22

Regarding the design of an operating system, it is always said that it is *machine dependent*. Which of the following arguments are the explanations for the above conception?

(i) Consider that a processor as a machine. Different processors have different architectural designs. Thus, the instruction sets provided by different processors are different. The design of an operating system relies on the instruction set provided. Therefore, the operating systems developed for different processors would be different. That is to say, they are machine dependent.

(ii) Consider that a computer as a machine. Different computers might have different hardware designs. The operating system is design to manage those hardware in a computer. Therefore, the operating system developed for different computing machine would be different. That is to say, they are machine dependent.

(iii) An operating system is designed to provide functions to support various applications. Therefore, the design of an operating system must be machine dependent.

Answers:

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

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

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

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

Question 23

Which of the following statement about medium access control (MAC) is true?

(a) If a computer has detected that the medium is being in use, the computer will wait for a fixed period of time and then re-detect the medium seeing if it is in use. If the medium is not in use, it sends out the message to the medium.

(b) If a computer has detected that the medium is being in use, the computer will wait for a random period of time and then re-detect the medium seeing if it is in use. If the medium is not in use, it sends out the message to the medium.

(c) If a computer has detected that the medium is not in use, the computer will wait for a fixed period of time and then re-detect the medium seeing if it is in use. If the medium is not in use, it sends out the message to the medium.

(d) If a computer has detected that the medium is not in use, the computer will wait for a random period of time and then re-detect the medium seeing if it is in use. If the medium is not in use, it sends out the message to the medium.

(e) None of the above.

Question 24

CSMA/CA is a MAC protocol. Which of the following system(s) has(have) applied this protocol?

(i) WiFi network.

(ii) 3G/4G telecommunication network.

(iii) Ethernet.

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 25

Which of the following devices have a MAC address?

(i) Notebook computer.

(ii) Personal computer.

(iii) iPhone.

Answers:

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

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

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

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

Question 26

Which of the following technology(ies) is(are) developed under the Internetworking Protocol?

(i) Format of port ID.

(ii) Format of an IP Address.

(iii) Ping.

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 27

Which of the following statements about *port number* are true?

(i) Each application server (web server for instance) is usually assigned to a unique port number.

(ii) Once a message has arrived a computer, the network operating system will check the port number specified in the message and then pass the message to the corresponding application server queue.

(iii) Two different application servers, say email server and web server, can use the same port number.

Answers:

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

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

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

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

Question 28

Which of the following stuffs are included in an IP datagram?

(i) Source and destination MAC addresses.

(ii) Source and destination IP addresses.

(iii) Source and destination PORT numbers.

Answer:

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

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

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

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

Question 29

Which of the following information are needed for the operating system to identify which browser the data in an IP datagram should be pass to?

(i) IP address.

(ii) Session ID.

(iii) Process ID.

Answers:

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

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

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

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

Question 30

Which of the following factors are the causes of packet loss in a wireless network?

(i) Channel noise being corrupted to the radio signal.

(ii) A packet has been forwarded for TTL times.

(iii) Nuclear explosion around the wireless network.

Answer:

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

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

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

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

Question 31

Which of the following factors will affect the data transmission rate in wireless network?

(i) Error bit rate.

(ii) Data signal frequency.

(iii) Carrier wave frequency.

Answer:

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

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

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

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

Question 32

Which of the following technologies/standards are not embraced in TCP/IP?

(i) ASCII format..

(ii) Encryption technology.

(iii) IP address format.

Answer:

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

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

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

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

Question 33

Which of the following arguments are *true*?

(i) The initial development of CSMA/CA technology was used in AlohaNET.

(ii) In the 1970s, data communication between Hawaii and California had to rely on satellite communication.

(iii) AlohaNET was developed by a research team from UCLA.

Answer:

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

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

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

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

Question 34

Which of the following statement(s) regarding the protocol CSMA/CA is(are) correct?

(i) A device needs to send out a RTS message to the medium once it has a frame of data to be sent to another device.

(ii) If there is a collision, i.e. multiple devices send out RTS messages at the same time, a device has to wait for a constant time and then re-send the RTS message to the medium.

(iii) A device can send out a frame of data to the medium only if it has received the CTS message.

Answer:

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

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

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

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

Question 35

Which of the following medium(media) is(are) a communication medium for Internet?

(i) Air.

(ii) Copper cable.

(iii) Fiber-optic cable.

Answer:

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

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

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

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

Question 36

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.yahoo.com. Which of the following reason(s) is(are) likely the cause(s) of this connection failure?

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

(i) There is no WiFi access point around.

(ii) The DNS in the telecom firm is down.

(iii) Web server www.yahoo.com is down.

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 37

Which of the following statements are *true*?

(i) One purpose of the Project Loon is to build a wireless network up in the sky.

(ii) One purpose of the Project Loon is to release the Internet traffic load.

(iii) One purpose of the Project Loon is to extend the coverage of Internet to the deserts and rural areas.

Answer:

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

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

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

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

Question 38

If we would like to show the following text on a webpage, which of the following codes should be added?

John Sum.

In the HTML file, what would be the correct coding for it?

(i) `<b><i>John Sum</i></b>`

(ii) `<i><b>John Sum<b></i>`

(iii) `<i><b>John Sum</i></b>`

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 39

Which of the following commands should be put in a file 'index.html' and function correctly? Here is the file structure of the web files.

```
web/misc/poker01.cpp
         poker02.cpp
         bubblesort01.cpp
   /photo/john2009.jpg
          john2017.jpg
          john2019.jpg
   /index.html
    cs.html
```

(i) `<a href="www.nchu.edu.tw">NCHU</a>`

(ii) `<a href="misc/john2009.jpg">John</a>`

(iii) `<a href="misc/poker01.cpp">Poker</a>`

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

Here is a segment of HTML code.

```
<table>
<tr> <td>Instructor:</td>
     <td>John Sum</td> </tr>
<tr> <td>Office:</td>
     <td>Room 821</td></tr>
<tr> <td>Time:</td>
     <td>Friday 09:10-12:00 </td> </tr>
<tr> <td>Classroom:</td>
     <td>CS121</td> </tr>
</table>
```

Once the above program segment is interpreted, what will you see on the browser.

(a)
```
Instructor: John Sum
Office: Room 821
Time: Friday 09:10-12:00
Classroom: CS121
```

(b)
```
Instructor:John Sum
Office:    Room 821
Time:      Friday 09:10-12:00
Classroom: CS121
```

(c)
```
Instructor: John Sum
Office:     Room 821
Time:       Friday 09:10-12:00
Classroom:  CS121
```

(d)
```
Instructor:John Sum
Office:Room 821
Time:Friday 09:10-12:00
Classroom:CS121
```

Question 41

Here is the access matrix for users John, Mary, Peter, application system A, and application system B.

	F1	F2	F3
John	orw	rw	
Mary	r		orw
Peter		orw	rw

o: owner, r: read, w: write, e: execute
EG: John can execute AS1 and AS2 to do anything.

Which of the following information leakage(s) could happen?

(i) Information in F1 could be leaked to Peter.

(ii) Information in F2 could be leaked to Mary.

(iii) Information in F3 could be leaked to John.

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 42

Refer to the artificial CPU and its commands, what will be the content of $M4$ if the following commands are executed?

```
DEF M1 1
DEF M2 2
DEF M3 5

MOV IA M1
IF IA == 0
   MOV IA M2
   MOV IA M2
   MOV IB M3
   ADD IA IB
```

```
   MOV M4 OUT
ELSE
   MOV IA M1
   MOV IA M1
   MOV IB M3
   MUL IA IB
   MOV M4 OUT
ENDIF
```

(a) 2.

(b) 7.

(c) 5.

(d) 0.

(e) None of the above.

Question 43

What will be the content of $M4$ if the following program segment is executed?

```
DEF M1 16
DEF M2 22
DEF M3 10
MOV IA M1
MOV IB M2
CMP IA IB
CMP IA IB
MOV M4 OUT
MOV IA M2
MOV IB M3
CMP IA IB
CMP IA IB
MOV IA OUT
MOV IB M4
ADD IA IB
MOV M4 OUT
```

(a) 28.

(b) 30.

(c) 32.

(d) 34.

(e) None of the above.

Question 44

Refer to the artificial CPU and its commands, what will be the content of $M4$ if the following commands are executed?

```
DEF M1 0
DEF M2 2
DEF M3 5

MOV IA M1
IF IA == 0
   MOV IA M2
   SHL IA 00000100
   MOV IA OUT
   MOV IB M2
   ADD IA IB
   MOV M4 OUT
ELSE
   MOV IA M3
   SHL IA 00000100
   MOV IA OUT
   MOV IB M3
   ADD IA IB
   MOV M4 OUT
ENDIF
```

(a) 4.

(b) 6.

(c) 8.

(d) 10.

(e) None of the above.

Question 45

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
MUL IA IB
MOV IA OUT
MOV IB M3
MUL IA IB
MOV IA OUT
MOV IB M4
SUB IA IB
MOV M5 OUT
----------------
```

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

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

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

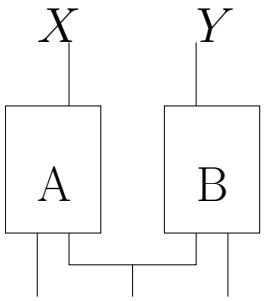
(c) $M5 = M1 \times M2 \times M3 - M4$.

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

(e) None of the above.

Diagram for Questions 46-50

The following schematic diagram is for Question 46 to Question 50. It is a circuit consisting of two logic gates.



Question 46

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) $X = 1, Y = 1$.

(e) None of the above.

Question 47

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) $X = 1, Y = 1$.

(e) None of the above.

Question 48

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) $X = 1, Y = 1$.

(e) None of the above.

Question 49

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) $X = 1, Y = 1$.

(e) None of the above.

Question 50

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) $X = 1, Y = 1$.

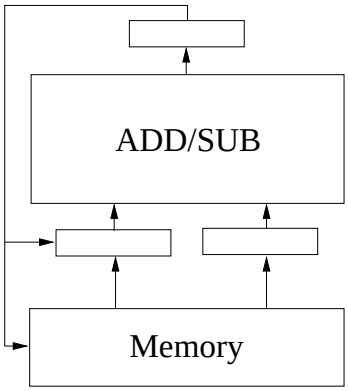
(e) None of the above.

APPENDIX

In this appendix, it includes the information about the artificial CPU and the source codes of five programs. Please read them carefully!

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.



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.

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.

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)

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	$OUT = b_1b_2b_3b_4b_5b_6b_7b_8$. $b_i = 0$ 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.

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
------------------------
```