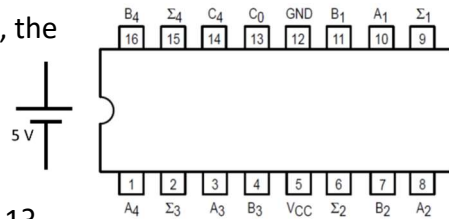1. The development of computer hardware can be roughly categorized to four or five generations. The methods of manufacturing electronics are used to separate the generations. Could you describe the manufacturing techniques or the electronic components used in the 1st, the 2nd, the 3rd, and the 4th generation of computers? (10%)

第一代：真空管技術，第二代：電晶體製程技術，第三代：Integrated Circuit (積體電路 IC)，第四代：Very Large Scale Integrated Circuit (超大型積體電路 VLSI)

2. For a signed 8-bit integer, please show the decimal numbers of -80, -11, 7, 111 in their signed binary form. (5%)

-80:   1011 0000
-11:   1111 0101
7:        0000 0111
111:      0110 1111

3. For a Motora 74LS83 shown in the right figure, the input pins are A$_1$-A$_4$ and B$_1$-B$_4$. If you have a 5 V voltage source, how do you connect the wire to the chip and demonstrate the addition of the binary operation of 0011 + 1011? Please write down the output voltages on the pins of Σ$_1$-Σ$_4$. (10%)

Pin Σ$_4$: 5 V, Σ$_3$: 5 V, Σ$_2$: 5 V, Σ$_1$: 0 V
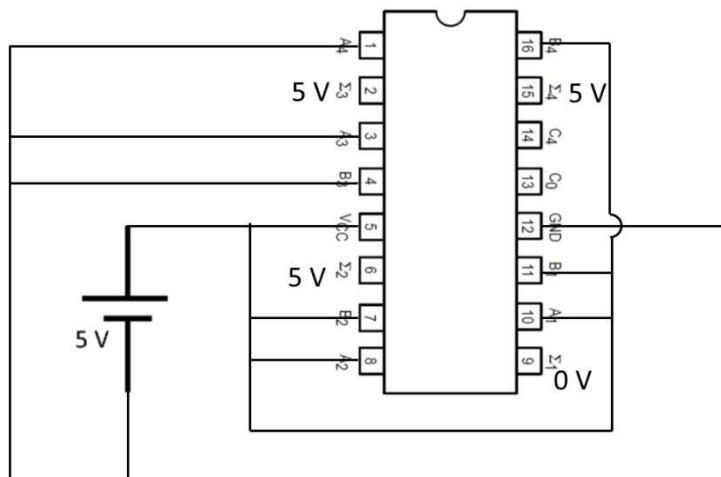
4. Please use 8-bit signed binary numbers to show how computer calculate the decimal number operation of 9 x 11 = 99. (5%)

11=1+2+8 → shift to left 0 bit, 1 bit, and 3bit

9: 00001001

shift 0 bit: 00001001

shift 1 bit: 00010010

shift 3 bit: 01001000

total sum: 01100011

5. The right figure shows the electronic circuit of the logic gate, the 'not' gate. Please describe how the not gate is operated. For example, please illustrate the input signal of 0 and 1, represented as 0 and 5 V, respectively on one port (one end of the wire) and describe the output signal. Remember to explain how the transistor work for the 'not' gate operation. (10%)
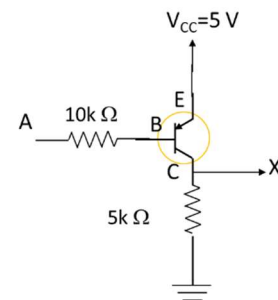
A: 0 (0 V) → X: 1(5 V) 因為 EB 正向電壓使得 EBC 導通電阻下降，此時 5 V 壓降會降在 X 位置上

A: 1 (5 V) → X: 0(0 V) 因為 EB 反向電壓使得 EBC 電阻遠大於 5 kOhm，此時 5 V 壓降會降在 E 與 C 之間，因此 C 會是 0 V

6. Please write the truth table of the right combinational logic gates. Please explain that which output pin (C or D) can be used as a summation result of a one-bit adder and which pin can be a carry out pin. (10%)
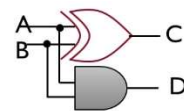
A	B	C	D
false	false	false	false
true	false	true	false
false	true	true	false
true	true	false	true

Pin D is a carry out pin.

Programming:

You can choose to answer either Question 1 or Question 2.

1. Please use the DOS batch file to prepare a program with the following functions (25%):

    A. please print out your name and student id
    B. ask the user to input a string
    C. print out once for the 1st character in the 1st row, twice for the 2nd character in the 2nd row, three times for the 3rd character in the 3rd row, … (for example, you get a string of "abcd" and print out:

        a
        bb
        ccc
        dddd)

```
@echo off
echo My name is XXX and my student ID is xxxxxxxx.
set /p name=Input a string:
set cntr=1
:loop1
set ni=1
set str=
:loop2
set str=%str%%name:~0,1%
set /a ni=ni+1
if %ni% leq %cntr% goto loop2
echo %str%
set name=%name:~1%
set /a cntr=cntr+1
if "%name%" neq "" goto loop1
pause
```

2. Please use the DOS batch file to prepare a program with the following functions (25%):

    D. please print out your name and student id
    E. ask the user to input a string
    F. print out the even and odd number of the string characters (for example, the user give you a string of "abcdef", you print out: "odd number characters are 'ace' and even number characters are 'bdf'")

```
@echo off
echo My name is XXX and my student ID is xxxxxxxx.
set /p name=Input a string:
set ostr=
set estr=
set cntr=1
:loop1
    set /a rmn=cntr %% 2
    if %rmn% == 1 set ostr=%ostr%%name:~0,1%
    if %rmn% == 0 set estr=%estr%%name:~0,1%
    set /a cntr=cntr+1
    set name=%name:~1%
if "%name%" neq "" goto loop1
echo Odd number chars: %ostr%
echo Even number chars: %estr%
pause
```

All you have to answer Question 3.

3. Please use the DOS batch file to prepare a program with the following functions (25%):

    A.   please print out your name and student id

    B.   ask the user to input an octal number

    C.   convert it to decimal and binary numbers and print them out

```
@echo off
echo My name is XXX and my student ID is xxxxxxxx.
set /p num=Input an octal number:
set exp=1
set total=0
:loop1
    set dgt=%num:~-1%
    set /a total=total+dgt*exp
    set /a exp=exp*8
    set num=%num:~0,-1%
if "%num%" neq "" goto loop1
echo decimal form: %total%
set ostr=
```

```
:loop2
    set /a rmn=total %% 2
    set /a total=total / 2
    set ostr=%rmn%%ostr%
if %total% neq 0 goto loop2
echo binary form: %ostr%
pause
```