Ch 1 ~ 4.1_Midterm

The following table is the "language description table."

Op-code	Operand	Description
1	RXY	LOAD the register R with the bit pattern found in the memory cell whose address is XY. *Example:* 14A3 would cause the contents of the memory cell located at address A3 to be placed in register 4.
2	RXY	LOAD the register R with the bit pattern XY. *Example:* 20A3 would cause the value A3 to be placed in register 0.
3	RXY	STORE the bit pattern found in register R in the memory cell whose address is XY. *Example:* 35B1 would cause the contents of register 5 to be placed in the memory cell whose address is B1.
4	0RS	MOVE the bit pattern found in register R to register S. *Example:* 40A4 would cause the contents of register A to be copied into register 4.
5	RST	ADD the bit patterns in registers S and T as though they were two's complement representations and leave the result in register R. *Example:* 5726 would cause the binary values in registers 2 and 6 to be added and the sum placed in register 7.
6	RST	ADD the bit patterns in registers S and T as though they represented values in floating-point notation and leave the floating-point result in register R. *Example:* 634E would cause the values in registers 4 and E to be added as floating-point values and the result to be placed in register 3.
7	RST	OR the bit patterns in registers S and T and place the result in register R. *Example:* 7CB4 would cause the result of ORing the contents of registers B and 4 to be placed in register C.
8	RST	AND the bit patterns in register S and T and place the result in register R. *Example:* 8045 would cause the result of ANDing the contents of registers 4 and 5 to be placed in register 0.
9	RST	EXCLUSIVE OR the bit patterns in registers S and T and place the result in register R. *Example:* 95F3 would cause the result of EXCLUSIVE ORing the contents of registers F and 3 to be placed in register 5.
A	R0X	ROTATE the bit pattern in register R one bit to the right X times. Each time place the bit that started at the low-order end at the high-order end. *Example:* A403 would cause the contents of register 4 to be rotated 3 bits to the right in a circular fashion.
B	RXY	JUMP to the instruction located in the memory cell at address XY if the bit pattern in register R is equal to the bit pattern in register number 0. Otherwise, continue with the normal sequence of execution. (The jump is implemented by copying XY into the program counter during the execute phase.) *Example:* B43C would first compare the contents of register 4 with the contents of register 0. If the two were equal, the pattern 3C would be placed in the program counter so that the next instruction executed would be the one located at that memory address. Otherwise, nothing would be done and program execution would continue in its normal sequence.
C	000	HALT execution. *Example:* C000 would cause program execution to stop.

TWO:
+ 0
− 1

Excess
+ 1
− 0

Multiple Choice Questions (10%)

10 11 12
A B C

(C) 1. Which of the following is the binary representation of −28 in two's complement format?
A. 01011100 B. 11101100 C. 11100100 D. 00011100

(B) 2. What is binary equivalent of $(24C)_{16}$?
A. 001001001000 B. 001001001100 C. 011001001100 D. 001101011100

(B) 3. Which of the following representations is erroneous? A. $(EEE)_{16}$ B. $(10211)_2$ C. $(342)_8$ D. 145

(C) 4. Which of the following instructions (as described in the language description table) will not change the contents of register 4? A. 1406 B. 2405 C. B403 D. A407

(C) 5. What is the result of an arithmetic right shift operation on the pattern 10011000? The pattern is an integer in two's complement format. A. 00110000 B. 00110001 C. 11001100 D. 01001100

Logic Right Shift：不考慮符號位，右移一位左補0

Arithmetic Right Shift：考慮符號位，符號位=1，左補1，反之補0

Fill-in-the-blank/Short-answer Questions (90%)

1. What are the components of CPU? (6%)

Arithemetic / Logic Unit、Control Unit、Register Unit

2. The following table shows a portion of a machine's memory containing a program written in the language described in the language description table. Answer the questions below assuming that the machine is started with its program counter containing 02. (6%)

address	content	address	content
00	10	07	05
01	02	08	C0
02	24	09	00
03	1D	0A	C0
04	B4	0B	00
05	0A	0C	C0
06	10	0D	00

A. What bit pattern will be in register 0 when the machine halts?
B. What bit pattern will be in register 4 when the machine halts?

1002
24LD
B40A
10 05
C000

A : 0A
B : 10

Reg. 0 1 2 3 4
0A 24 10

3. Decode each of the following instructions that were encoded using the language description table. (8%)

A. 4034 將 Register 3 的內容複製到 Register 4 中
B. 8023 對 Register 2 和 Register 3 之值做 AND 運算，並將結果存於 Register 0
C. B288 比較 Register 2 與 Register 0 的值，若相同則將 88 置於 Program Counter，否則繼續執行下一則指令。
D. 2345 將值 45 置於 Register 3 中。

4. When does a truncation (round-off) error occur and why? (6%)

由於 Floating-Point notation 的 Mantissa 僅有 4 個 Bit，因此當數值轉成 Binary 後的 Raw bit Patterns 若大於 4 個 Bit，多的 Bit 會被捨棄，便發生捨位誤差。

5. Using an 8-bit floating-point format in which the most significant bit is the sign bit, the next three bits represent the exponent field in excess notation, and the last four bits represent the mantissa, write the bit pattern that represents the value $2\frac{3}{4}$. (Use normalized form.) (5%)

0 110 1011

2+0.75
1 ✓ 0 ✓
2|2 2|1
2 0 0 1

0.75 × 2 = 1.50
0.50 × 2 = 1.00

(+2)
0 110 1011
Exp Mantissa

10.11 → RBP : 1011

6. What is the difference between cluster computing and grid computing? (5%)

cluster computing 利用數台高效能電腦彼此連接，通常位於同個地理位置。
gird computing 則是有數百萬台家用電腦組成，他們不一定彼此相連，通常也分散於世界各地。

7. What is the output of "print(bin(0b10011010 | 0b11001001))". (5%)

1001 1010
1100 1001
1101 1011

Ans : 1101 1011

8. What kind of network device is necessary to form the Internet? Explain your answer. (6%)

Router，因為他能夠將兩個不相容的網路(e.g. 乙太網路與 wifi)連接，形成網際網路。

9. Can we execute an unconditional jump in the machine instruction? Explain your answer and give an example. (6%)

Example : B02A
Jump 的條件是比較 Register 0 和指定的 Register 地址之值是否相等，若相等則 Jump，因此若將欲比較的 Register 地址設為 0，由於 Register 0 與 Register 0 之值必相等，便可以達成 unconditional jump.

10. What is the output of "print(bin(0b10011010 & 0b11001001))". (5%)

```
10011010
11001001
--------
10001000
```

10001000

11. What's controller? (5%)

Controller 是負責處理电腦與其他裝置通信的裝置。

12. What are the advantages of mass storages over main memory? (6%)

Mass Storage 不依靠电力維持資料且成本低

13. What is the difference between procedures and fruitful functions? (5%)

fruitful functions 有 return value

procedures 沒有 return values.

14. In the tree structure of software classification, what two parts does an operating system can be further divided into? (6%)

user interface & Kernel

15. What's pipelinging? (5%)

指令管線化，是一種提升指令運行效率、提高电腦系統吞吐量的技術。在指令沒有相依性的情況下，可以透過重疊機器周期來達成。

16. Describe the functionality of dispatcher in the process administration. (5%)

Dispatcher 旨在控制 process table 的 Time Slice.