國立臺灣科技大學 110 年度產業碩士專班招生(秋)試題

專 班 別：AI 跨域應用

科　　目：計算機概論

選擇題

總分 100 分，選擇題務必於答案卷內依序做答，否則不予計分。

1. (14 points)

Match the following terms with their descriptions.

a. Boolean operation

b. ASCII

c. truncation

d. bit

e. memory-mapped I/O

f. ROM

g. kernel

(1) A system developed by the American Standards Institute for encoding text

(2) Memory area whose contents cannot be altered

(3) The technique of communicating with peripheral devices as though they were memory cells

(4) The heart of an operating system

(5) Binary digit

(6) AND, OR, XOR, NOT

(7) An error that may occur when using floating-point notation

2. (12 points)

Sort the following terms according to its time complexity from high to low.

a. $O(n^2)$ b. $O(2^n)$ c. $O(n^n)$ d. $O(\sqrt{n})$ e. $O(n \log n)$ f. $O(n!)$

3. (10 points)

Suppose an array with six rows and eight columns is stored in row major order starting at address −50 (base 10). If each entry in the array requires two memory cells, what is the address of the entry in the fifth row and seventh column?

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4. (15 points)

Suppose the memory cells at addresses 00 through 0D in the machine described in the appendix contain the following bit patterns:

Address	Contents
00	20
01	5E
02	21
03	01
04	40
05	12
06	51
07	12

Address	Contents
08	B1
09	0C
0A	B0
0B	06
0C	C0
0D	00

Assume that the machine starts with its program counter containing 00.

a. What value will be in register 0 when the machine halts?

b. What value will be in register 1 when the machine halts?

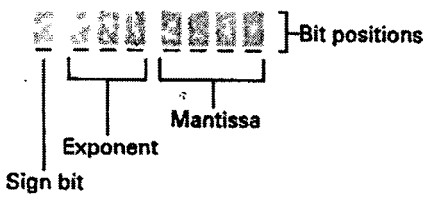
c. What value is in the program counter when the machine halts?

5. (18 points)

a. Convert the base 10 representation '-12' to its equivalent excess 16 representation.

b. Convert the two's complement representation '110110' to its equivalent base 10 representation.

c. Decode the bit pattern '10101100' using the floating-point format described in the following figure. Note that the **Exponent** field (i.e., 010) is presented using excess four notation, and the **Mantissa** field (i.e., 1100) stands for 0.1100 in binary representation. Write your answer in fraction form.



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6. (10 points)

Suppose a multiprogramming operating system is allotting time slices of 50 milliseconds. If it takes 8 milliseconds to position a disk's read/write head over the desired track and another 17 milliseconds for the desired data to rotate around to the read/write head, how much of a program's time slice is spent waiting for a read operation from a disk to take place? If the machine is capable of executing 10 instructions each nanosecond, how many instructions can be executed during this waiting period?

7. (10 points)

If the longest path in a binary tree contains exactly five nodes, what is the maximum number of nodes that could be in the entire tree?

8. (11 points)

What sequence of numbers would be printed if the following function is executed with the value of N being 0?

```
def inc(N):
    while (N < 4):
        print(N)
        N = N + 2
        print(N)
```

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Appendix

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 registers 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.