

考試科目	計算機概論 A8211	所別	資訊科學系碩士在職專班	考試時間	2月28日(日) 第四節
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You can write down your answer either in English or in Chinese (答案可用英文或中文撰寫)

1. (12%) IPv4 addresses are divided into three different classes: class A, class B and class C.
 - (a) (6%) How do we identify each class (ie., how do we know the corresponding class when receiving an IPv4 address)?
 - (b) (6%) How many bits are designed for the host part in each class A,B and C?
2. (4%) Carrier Sense Multiple Access (CSMA) is a Media Access Control (MAC) protocol. It defines how network devices respond when two devices attempt to use a data channel simultaneously. There are several CSMA access modes. For example, P-persistent mode is used in CSMA/CA systems, like Wi-Fi. Explain what the P-persistent mode is?
3. (10%) Describe how the number of comparisons used in the worst case changes when the size of the list to be sorted changes from n to kn , where k and n are two positive integers and the bubble sort algorithm is used.
4. (10%) Consider the following recursive, probabilistic algorithm A. It takes as input a list L of n items x_1, \dots, x_n .

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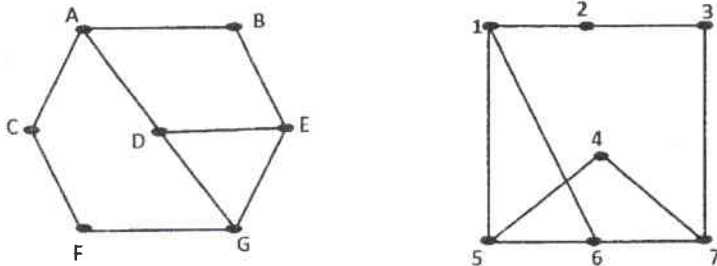
if  $n \leq 1$  then
    return
else
    for  $i \leftarrow 1$  to 3 do
        initialize an empty list  $L_i$ 
        for  $j \leftarrow 1$  to  $n$  do
            flip a fair coin: if it comes up "heads," append  $x_j$  to  $L_i$ 
            flip a fair coin: if it comes up "heads," recursively call A on input  $L_i$ 
  
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What is the expected running time (expressed in Big-O notation) of this algorithm? Give a careful justification of your claim.

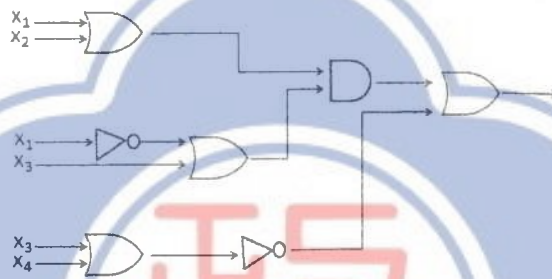
5. (6%) How many edges are there in a graph with 10 vertices each of degree six?
6. (8%) What is the von Neumann Model/Architecture and what is the von Neumann Bottleneck? How we solve the von Neumann Bottleneck in practice?

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7. (10%) Prove or disprove that these two graphs are isomorphic.



8. (10%) What is the output (i.e., Boolean expression) of the following circuit?



9. (10%) Analog-to-Digital Converter (ADC) is used to convert analog data into digital data. The basic analog-to-digital conversion process can be divided into a series of three operations. Each operation performs a specific task in the conversion process. What are the three operations and explain the functionality of each of the operations.

10. (20%) A certain machine with a 10 ns (10×10^{-9} s) clock period can perform jumps (1 cycle), branches (3 cycles), arithmetic instructions (2 cycles), multiply instructions (5 cycles), and memory instructions (4 cycles). A certain program has 10% jumps, 10% branches, 50% arithmetic, 10% multiply, and 20% memory instructions. Answer the following questions. Show your derivation in sufficient detail.

- What is the CPI (clock cycle per instruction) of this program on this machine?
- If the program executes 10^9 instructions, what is its execution time?
- A 5-cycle multiply-add instruction is implemented that combines an arithmetic and a multiply instruction. 50% of the multiplies can be turned into multiply-adds. What is the new CPI?
- Following (c) above, if the clock period remains the same, what is the program's new execution time?

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- 作答於試題上者，不予計分。
- 試題請隨卷繳交。