PART A: 選擇題 (20 分，每題 2 分)

1. Let $\bar{x}$ be the approximation of the real number $x$ using IEEE 754 single precision format. For which $x$ is $\bar{x} < x$ true?
   
   a) 0.1  
   b) 1.1  
   c) 0.3  
   d) 3.3

2. Let $x$ be a variable of type int in C++. Assuming that the current value of $x$ is 2, which expression doesn’t yield a value of 3?
   
   a) ++x  
   b) $x += 1.5$  
   c) $x = x + 1$  
   d) $x << 1 - 1$

3. Which controller is a high-speed serial interface that transfers data in packets?
   
   a) SCSI  
   b) FireWire  
   c) USB  
   d) IDE

4. Which connecting device operates at the first two layers of the OSI model?
   
   a) router  
   b) bridge  
   c) repeater  
   d) gateway

5. Which problem is known to be polynomial-time solvable?
   
   a) The problem of determining if a given integer is prime  
   b) The problem of determining if a Boolean formula is satisfiable  
   c) The problem of determining if a graph contains a Hamiltonian circuit  
   d) None of the above is polynomial-time solvable

6. Which problem is proved to be intractable?
   
   a) The towers of Hanoi problem  
   b) The traveling salesman problem  
   c) The halting problem  
   d) The knapsack problem

7. Which media access protocol and security protocol are used in IEEE 802.11b wireless local area network?
   
   a) CSMA/CA and WEP  
   b) CSMA/CA and WPA  
   c) CSMA/CD and WEP  
   d) CSMA/CD and WPA
8. Which statement is true?
   a) There is a 1-1 correspondence between IP addresses and email addresses.
   b) There is a 1-1 correspondence between IP addresses and DNS names.
   c) There is a 1-1 correspondence between IP addresses and MAC addresses.
   d) None of the above is true

9. Which statement is false?
   a) Flash memory is a type of EEPROM chip.
   b) A computer's BIOS chip is the most common form of flash memory.
   c) Flash memory and flash RAM are synonym.
   d) Digital cameras often use flash memory as storage media.

10. Which is not provided by digital signature?
    a) integrity
    b) authentication
    c) privacy
    d) nonrepudiation

PART B: 填充題（24 分，每題 2 分）

1. The ________ is a small program that has a single function: It loads the operating system into memory and allows it to begin operation.

2. The ________ problem, originally proposed by E.W. Dijkstra, is often used to illustrate the phenomena of deadlock and starvation.

3. ________ is a multiprogramming method in which a program can be divided into equally sized sections that need not be in memory at the same time for execution.

4. In the ________ method of synchronizing the operation of the CPU with the I/O device, the I/O device informs the CPU when it is ready for data transfer.

5. ________ is a design technique of algorithms that memoizes the already-computed results to avoid recomputing the same subproblem again and again.

6. A host has 140.113.110.181 as its IP address and 255.255.240.0 as its subnet mask. The address of the network to which the host connects is ________.

7. Instead of signing the whole message, the sender may use a ________ function to create a digest of the message and sign the digest only.
8 The _______ protocol is developed by Netscape for transmitting private documents via the Internet.

9 A _______ is a circuit that produces an output of 0 or 1 that remains constant until a temporary pulse from another circuit causes it to shift to the other value.

10 A _______ is often used to facilitate the traversal of a binary tree in level order.

11 The _______ test is one of the most disputed topics in artificial intelligence, philosophy of mind, and cognitive science. It is often used as a replacement for the question “Can machine think?”.

12 The _______ is a standard for specifying any kind of information on the Internet. It defines four things: method, host, port, and path.

PART C: 簡答題 (56 分，每題 8 分) 答案務必簡明扼要

1 a) Describe the language generated by the following grammar.
   \[ S \rightarrow aB \mid bA \]
   \[ A \rightarrow a \mid aS \mid bAA \]
   \[ B \rightarrow b \mid bS \mid aBB \]

   b) Is the language generated by the following CFG a regular language? Explain.
   \[ S \rightarrow aSa \mid \epsilon \]

2 True or False. Brief explanations are necessary.
   a) The running time of MERGESORT operating on an array of 9000 elements is \( O(1) \).
   b) Quicksort can be made to run in \( O(n \log n) \) in the worst case.

3 Let the frequencies of the symbols a, b, c, and d be 1, 1, 2, and 2, respectively.
   a) Construct a Huffman code tree.
   b) Give an optimal prefix code tree that is not a Huffman code tree.

4 In RSA, the public key is a pair of numbers \((n, e)\) and the private key is also a pair of numbers \((n, d)\).
   a) Suppose Alice wants to send a message \( m \) to Bob. How should Alice create the ciphertext \( c \)? How should Bob decrypt the ciphertext \( c \)?
   b) How to compute \( d \), given the public key \((n, e)\)?
5. a) What is NP-complete?
b) What can you say if an NPC problem belongs to P?

6. If the binary tree having the following traversals exists, draw it; otherwise, explain why it doesn’t exist. (The letters are the labels of the nodes of the binary tree.)
   a) preorder: ABDFCEGH
      inorder: FDBACGEH
   b) postorder: GFDAEBEC
      inorder: ABDCEFG

7. In the stack ADT below, all but the member functions push and pop are defined.

   ```cpp
   class stack
   {
   public:
      stack() : head(NULL) {}  
      void push(int);            
      void pop();                
      int top() const { return head->d; } 
      bool empty() const { return head==NULL; } 
   
   private:
      struct node {
         node(int d,node* next) : d(d),next(next) {}  
         int d; 
         node* next; 
      }* head; 
   };
   ```

   Define the two member functions push and pop outside the stack class. (For the member function pop, you may assume that the stack is not empty.)