

1. Briefly define the following terms: (15 分)

- (1) Cloud Computing      (2) Tunneling      (3) Context Switch  
(4) Critical Section      (5) DHCP

2. Multiple-choice questions: (10 分)

- (1) Which service is unreliable?  
(A) FTP      (B) TELNET      (C) SNMP      (D) nameserver
- (2) Which is not the characteristic of object-oriented programming?  
(A) polymorphism      (B) open source      (C) encapsulation      (D) inheritance
- (3) Which sorting algorithm has the least time complexity?  
(A) quick sort      (B) bucket sort      (C) heap sort      (D) merge sort
- (4) What is the port number for HTTPs (secure HTTP)?  
(A) 440      (B) 441      (C) 442      (D) 443
- (5) What is the value of variable  $i$  after executing the following piece of code?

```
int i=5;
if (4 > 9 & ++i >5) i--;
else i = i*2;
if (9>4 || ++i>10) i--;
```

- (A) 10      (B) 11      (C) 12      (D) 13

3. One video has the frame size of 640x480 pixels, color depth of 16 bits per pixel, and playback rate of 30fps. Its length is five minutes. What is the bit rate of this video (Mbps)? How much space to store this video (GBytes)? (10 分)

4. (1) What is multi-threading? What are its advantages? Give an example of your practical experience to elaborate your explanations. (5 分)

(2) Design the code to use three threads to compute the result of  $1+2+3+ \dots +9999$ . You may use one of the C, C++, and JAVA languages to design your code. (10 分)

5. Given a binary search tree, whose elements are all integers, as shown in Fig.1. Please answer the following questions: (15 分)

- (1)  $k = ?$
- (2) If we insert two elements into the tree, the first one is 5, and the second one is 18, please draw the binary search tree after these insertions.
- (3) And then, if we delete two elements, 17 and 20, from the binary search tree, please draw the binary search tree after these deletions.

6. Given a max heap, whose elements are all integers as shown in Fig. 2. Please answer the following questions: (15 分)

- (1)  $k = ?$
- (2) If we insert two elements into the heap, the first one is 20, and the second one is 5, please draw the max heap after these insertions.
- (3) And then, if we delete two elements from the heap, please draw the max heap after these deletions.

7. Please transform the forest in Fig. 3 into a Binary Tree. (5 分)

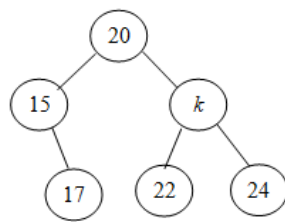
8. An array  $A[N_1, N_2, N_3]$  uses row major order and 4 bytes for each elements, compute the offset (in byte) of element with index  $(i, j, k)$  to the first byte address of the array. (5 分)

9. If you use the Dijkstra's algorithm to find all shortest paths from node  $a$  in Fig. 4. Please list the transitional distances to each nodes for the iteration in which node  $g$  will be included in the found shortest-path-node set. (5 分)

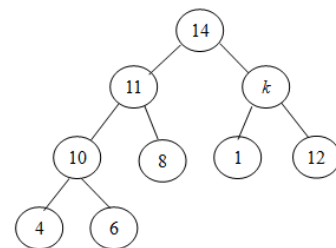
10. 如果採用 KMP pattern matching algorithm，請為下列樣版字串

**pat = a b c a b c a c a b**

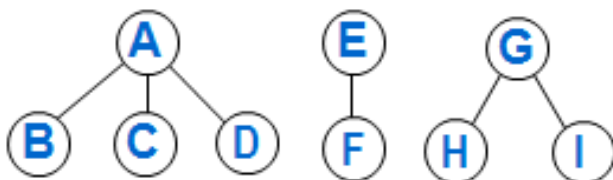
計算出每個位置的 failure function. (5 分)



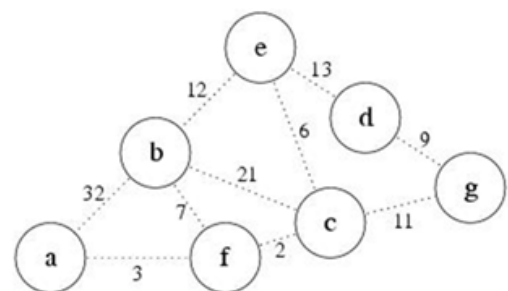
**Fig.1**



**Fig.2**



**Fig.3**



**Fig.4**