考試時間	月 日上午 下午第 節 （星期 ）晚間	份數		任課教師	

國立臺灣科技大學 101 學年度第 2 學期 博士班考試命題用紙 第 1 頁共 1 頁

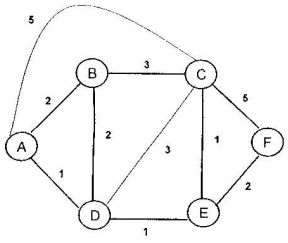
考試科目：ALGORITHM

☑研究所 ☐大學部 ☐工程在職進修 組別：

1. (20%) Answer the following two questions for merge sort.
   (a) Illustrate the operation of merge sort on the array
   A = {10, 47, 100, 58, 9, 20, 150}.
   Note that the input is not a power of 2.
   (b) Please analyze the time complexity of merge-sort.

2. (15%) Draw the recursion tree of the following recurrence, and determine the height, the cost in the same level, and a good asymptotic upper bound.
   $T(n) = T(n/3) + T(n/3) + T(2n/3) + cn$

3. (15%) *Given*: A network topology graph, *G*, with 6 nodes, and the link cost between nodes as shown below:



   Find: Using Dijkstra's Algorithm to find the least-cost paths for nodes A through F.

4. (20%) Let us discuss the *double hashing* with the hash function given by:
   $h(k, i) = h_1(k) + i\, h_2(k)$
   (a) Explain, possibly by an example why double hashing can perform better than quadratic probing.
   (b) If due to some programming error, the second function $h_2(k)$ always outputs a constant, what will the performance become?

考試時間	月 日上午 下午第 節 （星期 ）晚間	份數		任課教師	

國立臺灣科技大學 101學年度第 2 學期 博七班 考試命題用紙 第 2 頁共 2 頁

考試科目：ALGORITHM

☑研究所 ☐大學部 ☐工程在職進修 系班別：資檢考

5. (20%) We want to use dynamic programming to solve the longest common subsequence (LCS) problem for two sequences, with the following recurrence equation

$$c[i,j] = \begin{cases} 0 & \text{if } i=0 \text{ or } j=0, \\ c[i-1,j-1]+1 & \text{if } i,j>0 \text{ and } x_i = y_j \\ \max(c[i,j-1], c[i-1,j]) & \text{if } i,j>0 \text{ and } x_i \neq y_j \end{cases}$$

(a) Please use the recurrence equation to find an LCS for sequence X = "BCBDABA" and Y = "DCABB".

	-	D	C	A	B	B
-						
B						
C						
B						
D						
A						
B						
A						

(b) What is your strategy if we have three sequences instead? Write down your strategy as detailed as possible. No example given is necessary.

6. (10%) Explain when the depth-first search and breadth-first search will output the exactly identical result. Your answer should be as rigorous as possible.

考試時間	月 日上午 下午第 節 (星期) 晚間	份數		任課教師	

國立臺灣科技大學 101學年度第 2 學期 博士班 考試命題用紙 第 1 頁共 2 頁

考試科目：Operating System

☑研究所 ☐大學部 ☐工程在職進修 系班別：資檢所

1. The five process states are New, Running, Waiting, Ready, and, Terminated.
   (a) Which process state will a process be move to after it invokes a system call for synchronous I/O? (5%)
   (b) Which process state will a process be move to after it invokes a system call for asynchronous I/O? (5%)

2. Besides shared memory and message passing, pipe is another mechanism provided by operating systems for inter process communication within a computer. What are the advantages and disadvantages of pipe as compared with shared memory? (15%)

3. Which of the following components of program state are not shared across threads in a multithreaded process? (10%)
   (a) Register values, (b) Global variables, (c) Static local variables, (d) Dynamic (or automatic) local variables.

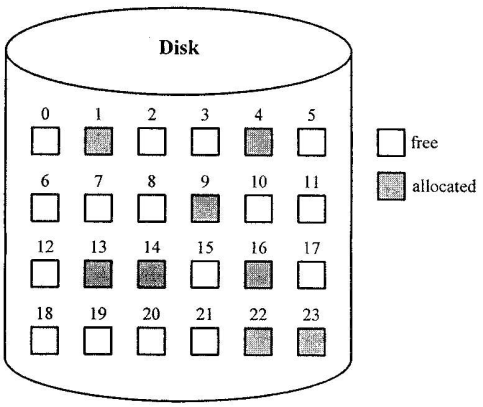
4. The program segment below is an implementation of critical section with swap( ) instruction. Can each of the three requirements, mutual exclusion, progress, and, bounded waiting, be satisfied? Show your answers. If some of the requirements cannot be satisfied, try to give your solutions. (15%)

```
do {
   key = TRUE;
   while (key == TRUE)
     swap(&lock, &key);
   // critical section
   lock = FALSE;
   // remainder section
} while (TRUE);
```

命題請勿超出線外

5. In a demand-paging system with associative registers, it takes 2 milliseconds to serve a page fault. A memory reference takes 200 nanoseconds and finding a page-table entry in the associative register takes 20 nanoseconds, determine the effective access time for a 90% hit ratio and 10% page fault ratio. (10%)

6. The following figure shows the current status of a disk. Please using following method to present the free blocks in this disk. (12%)
(a) Bit vector (b) Linked list (please link by the order of block number) (c) Grouping (assuming one free block can save four block numbers and one link) (d) Counting



7. Please explain following terminologies (18%)
(a) Aging
(b) Thrashing
(c) Belady's Anomaly
(d) Session Semantics
(e) Lazy Swapper
(f) Inverted Page Table

8. Suppose the head of a moving-head disk with 200 tracks, numbered 0 to 199, is currently serving a request at track 100 and just finished a request track 110. The queue of the requests is kept in the FIFO order: 88, 123, 94, 44, 102. What is the total number of head movements needed to satisfy these five requests for the following disk scheduling algorithms? (Please note that the head movements without gathering data are also included) (10%)
(a) FCFS (b) SSTF (c) SCAN (d) C-SCAN (e) LOOK