1. (a) What are the four necessary conditions for a deadlock situation? (6%)
   (b) What are the differences between deadlock and starvation? (3%)
   (c) Which of the following scheduling algorithms could result in starvation?
       i. First-come, first-served
       ii. Shortest job first
       iii. Round robin
       iv. Priority-based

   Explain your answer to receive full credit. (6%)

2. (a) List the main differences between processes and threads. (5%)
   (b) Describe the actions taken by a kernel to context-switch between processes. (5%)

3. Using semaphores is a solution to the critical-section problem, and one type of semaphore implementation is spinlock.
   (a) What is the primary disadvantage of spinlock? (4%)
   (b) How can we modify the *wait()* and *signal()* operations of semaphore to overcome the disadvantages of spinlock? (6%)

4. Consider the following snapshot of a system with four resource types and five processes:

	Allocation (A,B,C,D)	Max (A,B,C,D)	Available (A,B,C,D)
P1	(0,2,5,2)	(3,3,5,6)	(A,B,C,D)
P2	(4,2,0,0)	(5,5,0,1)	
P3	(0,4,2,2)	(0,4,4,2)	
P4	(2,0,1,1)	(3,0,1,1)	(2,0,1,X)
P5	(4,1,1,0)	(6,2,1,2)	

   Please answer the following questions using the banker's algorithm.
   (a) Show the content of the matrix *Need*. (5%)
   (b) If X=7, find out whether {P4, P3, P2, P1, P5} is a safe sequence or not. Explain your answer to receive full credit. (5%)
   (c) What is the smallest value of X to keep the system in a safe state? Explain your answer to receive full credit. (5%)
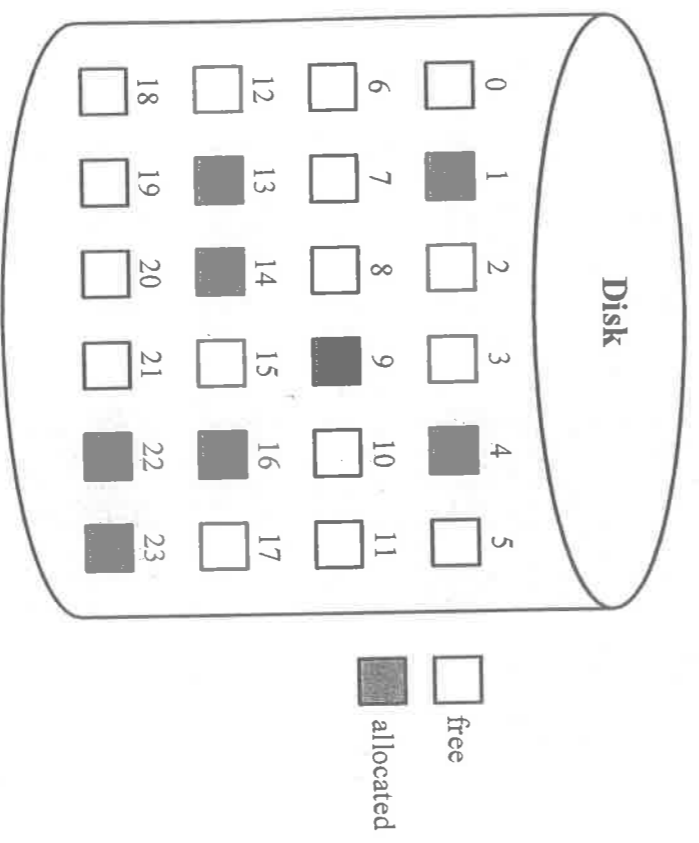
國立臺灣科技大學

考試科目：Operating Systems 107 學年度第 1 學期 博士班 甄試命題用紙 第 2 頁 共 3 頁

考 試 時 間 (星期) 晚間

□研究所
□大學部
□工程在職進修

博士班甄試命題用紙

慧吟對茲計類組是別?

5. Consider a 32-bit OS that runs on a machine with 64MB of physical memory. The OS divides the 32-bit logical address space into pages. Each page is sized of 4KB. There are 4 methods for translating a virtual address to a physical address:

(a) one-level page table

(b) two-level page table (the first level page table has 256 entries; we only need the first level page table and first one of the second level page table to be saved in memory)

(c) hashed paged table (the range of the value returned by the hash function is between 0 and 27)

(d) inverted page table.

Please calculate the memory space required for a process's page table, in each method under the assumption that each entry in the page table is sized of 4 bytes. (20%)

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

Disk

0	1	2	3	4	5
6	7	8	9	10	11
12	13	14	15	16	17
18	19	20	21	22	23

□ free

■ allocated

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107 學年度第 1 學期 學期 [研究所 / 大學部 / 工程在職進修] 轉學招考試命題用紙

考試時間 （星期　）晚間

月 日上午 下午

試　教　師　份　數

任課　教師

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7. An IDE hard disk spins at 7200 RPM, has 2 MB internal cache, 5000 cylinders, 20 tracks per cylinder, 120 sectors per track, 512 bytes per sector.

(a) Calculate the disk size. (2%)

(b) Estimate the transfer rate in bytes second. (3%)

(c) What is the access time (in the scale of milliseconds) for reading a file with size 0.36865 MB under the assumption that seek time is 4 milliseconds? (3%)

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: 86, 117, 91, 1, 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