1. (8%)

(a) What is the purpose of interrupts? (4%)

(b) What are the actions taken by a kernel to context-switch between processes? (4%)

2. (20%)

Consider the following set of processes, with the length of the CPU burst time given in milliseconds:

Process	Burst time	Priority
P_1	2	2
P_2	10	1
P_3	2	3
P_4	4	4

The processes are assumed to have arrived in the order P_1, P_2, P_3, P_4, all at time 0.

(a) Draw 4 Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, RR (quantum=1), non-preemptive priority. (4%)

(b) What is the turnaround time of each process for each of the scheduling algorithms in part (a)? (8%)

(c) What is the waiting time of each process for each of these scheduling algorithms in part (a)? (8%)

3. (22%)

Consider the following snapshot of a system with five processes (i.e., P1, P2, P3, p4 and P5) and four resource types (i.e., A, B, C and D):

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

Please answer the following questions based on the system snapshot provided above.

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考試科目： Operating System   108 學年度第 二 學期   考試命題用紙   第 二 頁 共 4 頁

考試時間 （星期 ）日上午/下午第 節 晚間

☑研究所
□大學部
□工程在職進修

系班別：

任課教師

命題請勿超出線外

傅也的覺得棒

(a) List and describe the four necessary and sufficient conditions for the establishment of Deadlock. (8%)

(b) Banker's algorithm is a deadlock avoidance algorithm. Show the content of the matrix *Need* when running the Banker's algorithm. (4%)

(c) If X=9, find out whether {P3, P4, P2, P5, P1} is a safe sequence or not. Explain your answer to receive full credit. (5%)

(d) What is the smallest value of X to keep the system in a safe state? Explain your answer to receive full credit. (5%)

4. (10%)

Consider the following states of five pages:

Page	Loading time	The last reference time	R bit	M bit	Accumulated reference bit
1	187	884	0	1	385
2	253	558	1	0	073
3	339	572	0	0	147
4	047	637	1	1	089
5	411	640	0	1	063

What is the replaced page under each of following algorithm? (a) FIFO (b) LRU (c) second chance (d) enhanced second chance (e) LFU

5. (8%)

The following figure shows the current status of a disk. Please using following method to present the free blocks in this disk.

Disk

□ free   ■ allocated
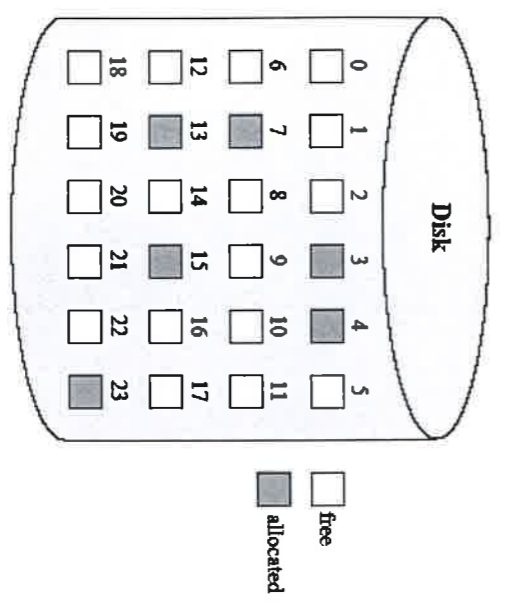
國立臺灣科技大學

考試科目： Operating System　　108 學年度第 二 學期　　考試命題用紙　第 3 頁 共 4 頁

考試時間：下午上午（星期　）晚間

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系班別：

任課教師：得分以上皆不給

命題請勿超出線外
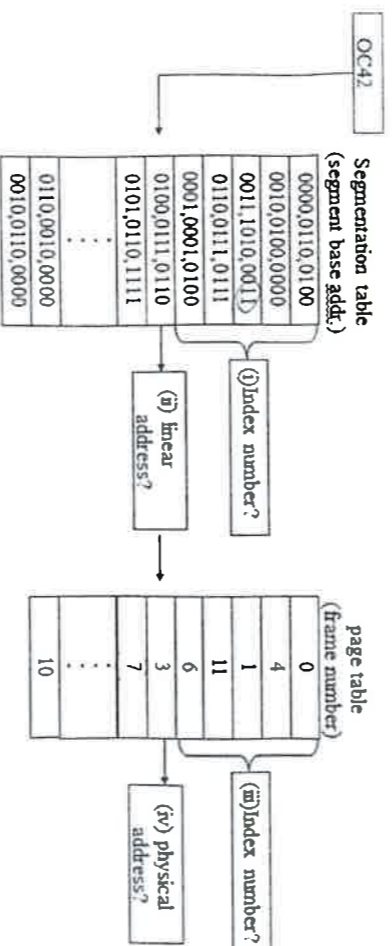
(a) Bit vector

(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

6. (12%)

Consider a byte-addressable computer system with a 16-bit virtual address, total physical memory size 4KB, page size is 256Bytes, the maximum size of segment is 1KB. Given the following segment table, page table and a 16 bits hexadeciaml logical address "0C42", complete the address translation diagram below.

(a) segment table index (b) linear address (i.e. in binary form) (c) page table index (d) physical address (i.e. in binary form)

```
0C42

Segmentation table                                      page table
(segment base addr.)                                    (frame number)
0000,0110,0100          (i)index number?                0
0010,0100,0000                                           4
0011,1010,0011          (ii) linear                      1
0110,0111,0111           address?        (iii)index      11
0001,0001,0100                            number?        6
0100,0111,0110                                           3
0101,0101,0111                                           7
....                    (iv) physical                    ....
0110,0010,0000           address?                        10
0010,0010,0000
```

7. (20%)

Describe the following items

(a) In NUMA system for frame allocation, why the goal is to have memory frames allocated "as close as possible" to the CPU on which the process is running?

(b) What is "Belady's anomaly" in page replacement

(c) What is acyclic-graph directories

(d) Why Interrupts from I/O device are much better than polling

(e) What is "double buffering in Kernel I/O Subsystem

(f) What is Direct Memory Access (DMA)

(g) Which of the following memory management methods is not for kernel process?

(1) Buddy system. (2) Slub. (3) Typical paging. (4) Slab

(h) Which of the following programming techniques and structures are "good" for

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考 試 時 間（星期　）

月 日 上午 下午 晚間

研究所 大學部 工程在職進修

系班別：

任課教師

博士班及不分系

a demand-paged environment?

(1) Hashed symbol table (2) Array (3) Linked List (4) Goto

(i) RAID have been widely used to provide reliability via redundancy. Please make the right binding between RAID-1 and one of following explanations.

(1) block-interleaved parity (2) non-redundant striping (3) mirrored disks (4) bit-interleaved parity

(j) Which is the wrong statement about the three major disk space allocation methods: contiguous, linked, and indexed allocation methods?

(1) The contiguous allocation method outperform others on seek time.

(2) The contiguous allocation method suffers from the problem of external fragmentation.

(3) It is inefficient to randomly access the linked allocation files.

(4) i-node is a kind of indexed allocation method.

(5) FAT is a kind of indexed allocation method.