

國立臺灣科技大學

九十二學年度碩士班招生考試試題

系所組別：資訊工程系碩士班

科目：作業系統

總分 100 分。第 1 題至第 17 題為選擇題，每題 3 分，全對共 50 分。選擇題務必於答案卷內依序作答，否則不予計分。例如，若你覺得第 1 題至第 5 題的空格應該分別填入 disabled、trap、job queue、ready queue、device queue，則你應該在答案卷內寫

1. (17)
2. (18)
3. (19)
4. (20)
5. (21)

You are given a pool of keywords:

- (1) polling, (2) vectored interrupt system, (3) interrupt, (4) main memory, (5) synchronous I/O, (6) asynchronous I/O, (7) booting, (8) bootstrap program, (9) kernel, (10) system call, (11) virtual machine, (12) magnetic disk, (13) disk controller, (14) volatility, (15) caching, (16) device controller, (17) disabled, (18) trap, (19) job queue, (20) ready queue, (21) device queue, (22) process migration, (23) long-term scheduler, (24) short-term scheduler, (25) context switch, (26) program counter, (27) I/O-bound process, (28) CPU-bound process, (29) direct memory access, (30) interrupt vector, (31) privileged, (32) timer, (33) limit register, (34) base register, (35) thread, (36) user thread, (37) kernel thread, (38) thread cancellation, (39) nonpreemptive, (40) preemptive, (41) dispatcher, (42) monitor, (43) semaphore, (44) race condition, (45) response time, (46) starvation, (47) critical section, (48) CPU utilization, (49) throughput, (50) turnaround time, (51) waiting time, (52) deadlock.

Fill in each of the 17 blanks below with the most suitable keyword from the pool. If you think the most suitable keyword for a blank should be capitalized, but the keyword in the pool is not capitalized, you can assume that the keyword is capitalized in the pool.

1. A ____ is a software-generated interrupt caused either by an error or a user request.
2. ____ is used for high-speed I/O devices able to transmit information at close to memory speeds.
3. ____ is the only large storage media that the CPU can access directly.



國立臺灣科技大學

九十二學年度碩士班招生考試試題

系所組別：資訊工程系碩士班

科目：作業系統

4. All I/O instructions are _____ instructions.
5. In order to have memory protection, we use two registers that determine the range of legal addresses a program may access. The _____ holds the smallest legal physical memory address.
6. A _____ interrupts the computer after a specified period to ensure that the operating system maintains control.
7. A _____ provides the interface between a process and the operating system.
8. The _____ is stored in ROM, and is able to locate the kernel, load it into memory, and start its execution.
9. The _____ is a list of all processes residing in main memory, ready and waiting to execute.
10. The _____ selects which processes should be brought into the ready queue.
11. A _____ spends more time doing computations than I/O.
12. The _____ selects from among the processes in memory that are ready to execute, and allocates the CPU to one of them.
13. The _____ gives control of the CPU to the process selected by the short-term scheduler.
14. The _____ is a situation where several processes access and manipulate shared data concurrently; the final value of the shared data depends upon which process finishes last.
15. _____ is a situation where two or more processes are waiting indefinitely for an event that can be caused by only one of the waiting processes.
16. _____ is a situation where processes wait indefinitely within the semaphore.
17. The _____ is a high-level synchronization construct ensuring that only one process at a time can be active within it.



國立臺灣科技大學
九十二學年度碩士班招生考試試題

系所組別：資訊工程系碩士班
科目：作業系統

18. (15%) Consider the operation of the computer memory paging system with 64 bits address space, with 16K size pages and 256MB main memory.
- If an inverted page table is used for the system, how many entries does the table have?
 - If a one-level physical page table is used, how many entries does the table have?
 - Describe what a valid bit associated with each page table entry is.
 - Many systems provide the hardware reference bit associated with each page table entry. Explain its use in page replacement.
 - Without reference bit hardware support, describe how OS can make use of the valid bit and page fault handler to implement page replacement algorithms. Specify how the page tables are used and any new data structures needed. Explain what happens on a read and write to a given page: if some read or write operations act differently than others, explain each case.
19. (15%) Consider a computer system with a simple paged virtual memory system (with no segments). First you measure the system, and discover the following values:

Pt = probability of a TLB miss	0.1
Pp = probability of a page fault when a TLB miss occurs	0.0002
Tt = time to access TLB	0
Tm = time to access memory	1 microsecond
Td = time to transfer a page to/from disk	10 milliseconds = 10000 microseconds
Pd = probability page is dirty when replaced	0.5

The TLB is only accessed once per reference. The page tables are kept in physical memory, so looking up a page table entry incurs one memory access. Assume that the costs of the page replacement algorithm and updates to the page table are included in the Td measurement.

- What does it mean when we say a page is dirty?
 - What is the average memory access time (the time for an application program to do one memory reference) on the computer assuming page faults never happen? Express your answer symbolically.
 - What is the average memory access time (the time for an application program to do one memory reference) on the computer? Express your answer symbolically.
 - Compute the result to two significant digits. *Show all steps of the computation.*
20. (10%) Consider a UNIX file system represented by the following skeletal INODE:

file name
date created
date modified
...
block 0 pointer (direct)



國立臺灣科技大學
九十二學年度碩士班招生考試試題

系所組別：資訊工程系碩士班
科目：作業系統

block 1 pointer (direct)
...
block 11 pointer (direct)
singly indirect block pointer
doubly indirect block pointer
triply indirect block pointer

Assume also that the disk sector and block sizes are both 8K. If the disk pointers are 32-bits with 8 bits to identify the physical disk and 24 bits to identify the physical block, then

- a. What is the largest file size supported?
 - b. What is the max partition size supported?
 - c. Assuming that no information other than the file INODE is already in main memory, how many disk accesses are required to access the byte at location 13,423,956 in the file?
21. (10%) Consider a demand paging system, where a dedicated disk is used for paging, and file system activity uses other disks. The measured utilizations of the various system components, in terms of **time**, not space, are as follows:

CPU utilization	20%
Paging disk	99.7%
Other I/O devices	5%

For each of the following changes, say what its most likely impact will be on CPU utilization: increase, no effect, or decrease, and explain *why*.

- a. Get a larger capacity paging disk
- b. Increase the degree of multiprogramming
- c. Get more physical memory

