Venue _____

Student Number |__|__|__|__|__|__|__|__|

Family Name _____

First Name _____

End of Semester 1, 2018
COMP2006 Operating Systems

Curtin University

School of Electrical Engineering, Computing and Mathematical Sciences

EXAMINATION

End of Semester 1, 2018

COMP2006 Operating Systems

This paper is for Bentley Campus and Miri Sarawak Campus students

This is a CLOSED BOOK examination

Examination paper IS NOT to be released to student

Examination Duration 2 hours

Reading Time 10 minutes

Notes in the margins of exam paper may be written by Students during reading time

Total Marks 100

Supplied by the University

None

Supplied by the Student

Materials

None

Calculator

No calculators are permitted in this exam

Instructions to Students

This paper consists of four (4) questions with the following breakdown of marks:

Question One: 20 marks
Question Two: 42 marks
Question Three: 24 marks
Question Four: 14 marks

ATTEMPT ALL QUESTIONS

Examination Cover Sheet

For Examiner Use Only

Q	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	

Total _____

QUESTION ONE (total: 20 marks): Deadlock

a) **(4 marks).** What is the similarity and difference between deadlock prevention and deadlock avoidance?

Answer:

b) **(4 marks).** What does a cycle indicate in each of the following graphs:

- A resource allocation graph.
- A wait for graph.

Answer:

c) **(4 marks).** Explain why an unsafe resource allocation state does not always lead to a deadlock state.

Answer:

d) **(Total: 8 marks).** For a state described in the following table:

Process	Allocation	Maximum
	R_1	R_1
P_1	1	3
P_2	1	2
P_3	3	9
P_4	2	6

(i) **(3 marks).** Is the system safe if the number of resources currently available is 2? Justify your answer.

(ii) **(3 marks).** Following the given state and provided there are 4 resources available, if P_3 asks for two resources allocation (in addition to the current allocation of 3), should the request be granted? Justify your answer.

(iii) **(2 marks).** Following the given state and provided there are 4 resources available, if P_2 asks for two resources allocation (in addition to the current allocation of 1), should the request be granted? Justify your answer.

Answer:

(i)

(ii)

(iii)

END OF QUESTION ONE

QUESTION TWO (total: 42 marks): Memory Management

a) **(2 marks).** Explain why a multitasking system needs a memory management unit.

Answer:

b) **(6 marks).** A page table can include the **valid/invalid bit** and the **lock bit**. Describe when each of the bits would be set or reset, and its use.

Answer:

c) **(Total: 8 marks).** Thrashing.

(i) **(2 marks).** What is thrashing?

(ii) **(4 marks).** Explain why thrashing occur.

(iii) **(2 marks).** Which page replacement strategy, local or global, is better to reduce thrashing? Justify your answer.

Answer:

(i)

(ii)

(iii)

d) **(4 marks).** When a new process is created, some system, e.g., Linux, uses a technique called copy-on-write. Describe the technique. What is the advantage of using copy-on-write?

Answer:

e) **(4 marks).** Consider a 32-bit address for a two-level paging system with an 8 KB page size. The outer page table has 1024 entries. Does the second-level page table use 12, 10, 9, or 8 bits? Show your work to justify your answer.

Answer:

f) **(4 marks).** Assume a system has a TLB hit ratio of 90%. It requires 15 nanoseconds to access the TLB, and 85 nanoseconds to access main memory. Is the effective memory access time for this system 22, 100, 108.5, 176.5 nanoseconds? Show your work to justify your answer.

Answer:

g) **(4 marks).** Consider a logical address 0xAEF9 (in hexadecimal) with a page size of 256 bytes. What is its page number? Is it 0xA, 0xAE, 0xF9, or 0x00F9? Show your work to justify your answer.

Answer:

h) **(Total: 6 marks).** Consider a reference string 2, 5, 1, 7, 8, 7, 3, 2, 1, 2, 3, 2, 4.

(i) **(3 marks).** How many page faults would there be using optimal replacement and 3 page frames? Show the last content of the page.

(ii) **(3 marks).** How many faults with LRU and 3 page frames? Show the last content of the page.

Answer:

(i)

(ii)

i) **(4 marks).** Describe two advantages and two disadvantages for increasing the page size.

Answer:

END OF QUESTION TWO

QUESTION THREE (total: 24 marks): File, I/O, and disk

a) **(4 marks).** What is a buffer? State the three reasons for using the buffer.

Answer:

b) **(6 marks).** Consider a system that supports the strategies of contiguous, linked, and indexed allocation. For a large file that is usually accessed in random, explain why using the contiguous and linked allocations are not as good as using the indexed allocation.

Answer:

c) **(4 marks).** What is the maximum file size supported by a file system with 16 direct blocks and one single indirect? Assume the block size is 512 bytes, and disk block numbers can be stored in 4 bytes. Justify your answer.

Answer:

d) **(Total: 6 marks).** Disk Scheduling

Disk requests come into the disk driver for cylinders 30, 12, 25, 2, 60, 16, and 28, in that order. Assume that the disk has 100 cylinders.

A seek takes 5 msec per cylinder moved. Compute the average seek time for the request sequence given above for

(i) **(3 marks).** LOOK.

(ii) **(3 marks).** C-SCAN.

In both cases, the arm is at cylinder 50, and the previous request it served was at cylinder 45

Answer:

(i)

(ii)

e) **(4 marks).** Could a RAID level 1 achieve better performance for read requests than a RAID level 0 (with nonredundant striping of data)? If so, how?

Answer:

END OF QUESTION THREE

QUESTION FOUR (total: 14 marks): Protection and Security

a) **(4 marks).** Give four reasons for operating systems to provide protection.

Answer:

b) **(6 marks).** Discuss if there is any difference between the *principle of least privilege* and the *need to know principle*. Also discuss the common objectives of the two principles.

Answer:

c) **(4 marks).** Describe the access matrix in the context of protection system.

Answer:

END OF EXAMINATION PAPER