

Massey University

ALBANY CAMPUS

EXAMINATION FOR 159.335
OPERATING SYSTEMS AND CONCURRENT PROGRAMMING
Semester One - 2002

Time Allowed: THREE (3) Hours

INSTRUCTIONS

Attempt ALL SEVEN (7) questions.

This final examination contributes 70% to the final assessment.
Calculators are permitted

Turn over to pg. 2...

1. (a) What is memory management? *[3 marks]*
- (b) What is a Distributed Operating System? *[2 marks]*
- (c) What is Multiprogramming? *[2 marks]*
- (d) Briefly explain the operation of a simple device driver for a keyboard. *[3 marks]*
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2. (a) Why does a system call need to switch the CPU to supervisor mode? *[2 marks]*
- (b) Give 6 pieces of information that must be stored in a Process Control Block(PCB)? *[3 marks]*
- (c) Draw a diagram to illustrate the life cycle of processes in an operating system which supports preemptive scheduling. *[2 marks]*
- (d) Draw a diagram to illustrate a typical distribution of process burst times. On your diagram, show a good value for the Round Robin time quantum and state why you have chosen this value. *[3 marks]*

3. (a) The following processes are to be scheduled

<i>Process</i>	<i>Arrival Time(ms)</i>	<i>Burst Time(ms)</i>
P ₁	0	30
P ₂	10	20
P ₃	15	10
P ₄	20	20
P ₅	30	10

Draw scheduling diagrams and calculate the average waiting time and response time for these processes when using the following algorithms.

- (i) FCFS
- (ii) SJF
- (iii) SRTF
- (iv) RR with $q=10$
- (v) RR with $q=30$

[6 marks]

(b) A system has 3 resource types, A, B and C. There are 4 instances of A, 3 instances of B and 2 instances of C. At a certain point in time, the resources are being used as follows:

Process	Allocation			Maximum		
	A	B	C	A	B	C
P ₁	1	0	1	2	1	2
P ₂	0	2	1	1	2	1
P ₃	2	1	0	3	3	1

Use the safety algorithm to show if this system is in a safe state or not.

[4 marks]

Turn over to pg. 4...

4. (a) Define and describe the three operations that are usually used when working with semaphores – create, wait and signal .

[3 marks]

- (b) Two threads execute the following sections of code

<i>Thread1</i>	<i>Thread2</i>
$t=x+y$	$t=y-x$
$x=x+t$	$x=x-t$

x and y are global variables and t is a temporary local variable.
If x initially has a value of 2 and y initially has a value of 1,
what are all the possible final values of x?

[5 marks]

- (c) A semaphore that is to be used as a mutex to protect a critical section is initialised to 0 instead of 1, what will happen to the program?.

[2 marks]

5. (a) Briefly describe the readers writers problem and give a pseudocode solution?

[4 marks]

- (b) Explain how your algorithm from part a) could suffer from starvation.

[2 marks]

- (c) What is a condition variable?

[2 marks]

- (d) Give 4 conditions that must be true for deadlock to occur

[2 marks]

Turn over to pg. 5...

6. (a) A Machine has a physical memory of four frames.
A Program generates the following page requests:
0,1,4,1,0,3,4,2,0,1,4
How many page faults does this sequence generate when using the following Page Replacement Algorithms?
- (i) FIFO - First In First Out
 - (ii) OPT - The Optimal Algorithm
 - (iii) LRU - Least Recently Used

[3 marks]

- (b) Briefly explain, using an example, how paging can allow the sharing of a library between many processes.

[3 marks]

- (c) Explain the purpose of the 'reference' bit in a page table entry.

[2 marks]

- (d) What is two level paging? Why is it used?

[2 marks]

Turn over to pg. 6...

7. (a) A 500MB file is stored using the UNIX system of combined indexing. The block size is 4k and block numbers are 32 bits.

(i) Draw a diagram to illustrate this indexing system

[2 marks]

(ii) Calculate the total number of blocks used by the index.
State any assumptions you make.

[2 marks]

(b) What is a logging file system? What is logged?

[3 marks]

(c) Describe how RAID Level 5 can be used to provide higher performance and reliability than individual disks.

[3 marks]

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