

# Massey University

## ALBANY CAMPUS

EXAMINATION FOR 159.335  
OPERATING SYSTEMS AND CONCURRENT PROGRAMMING  
Semester Two – 2000

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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) Briefly describe the sequence of events which occurs when a program asks the operating system to open a file on a hard disk. *[3 marks]*
- (b) What is a Distributed Operating System? *[2 marks]*
- (c) Give three reasons for using concurrent programming. *[3 marks]*
- (d) What is a buffer and where are buffers found? *[2 marks]*
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2. (a) What is the ready queue? When a process is in the ready queue, what is it ready to do. *[2 marks]*
- (b) Give 2 major differences between communication using message passing and using shared variables. *[3 marks]*
- (c) How do interrupts allow an operating system to stay in control of the hardware? *[3 marks]*
- (d) Briefly describe the Win32 CreateThread system call. *[2 marks]*

**Turn over to pg. 3 ...**

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

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

What is the average waiting time for these processes when using the following scheduling algorithms?

- (i) FCFS
- (ii) SRTF
- (iii) RR with a time quantum of 5 ms
- (iv) RR with a time quantum of 10 ms

Comment on these results.

*[6 marks]*

- (b) Draw a diagram to illustrate the expected distribution of burst times for processes in an average computer system.

*[2 marks]*

- (c) Briefly explain what the "Convoy Effect" is and how it affects FCFS scheduling.

*[2 marks]*

4. (a) Briefly outline the dining philosophers problem.

*[3 marks]*

- (b) Give a pseudocode solution to the dining philosophers problem using either semaphores or monitors.

*[7 marks]*

**Turn over to pg. 4 ...**

5. (a) What is the critical section problem?

[3 marks]

(b) Consider the following system which has 3 resource types, A, B and C. There are 3 instances of A, 2 instances of B and 3 instances of C.

Process	Allocation			Maximum		
	A	B	C	A	B	C
p <sub>1</sub>	1	0	1	2	1	3
p <sub>2</sub>	0	1	1	1	1	2
p <sub>3</sub>	2	1	0	2	1	2

i) Draw a resource allocation graph to illustrate this system.

[3 marks]

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

[4 marks]

6. Give definitions of the following terms.

- (a) Buddy allocation
- (b) The Sleeping Barber Problem
- (c) Deadlock Detection
- (d) Thrashing
- (e) Condition variable

[10 marks]

7. (a) A machine uses two level paging; it has a main memory access time of 50ns and a TLB with an access time of 15ns. The hit rate of the TLB is 99.9%. Calculate the effective memory access time.

[3 marks]

(b) Briefly describe the difference between a file system that uses indexed allocation and a file system that uses linked allocation.

[3 marks]

(c) What is internal fragmentation?

[2 marks]

(d) Briefly describe how paging allows processes to use shared libraries.

[2 marks]

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