Massey University
ALBANY CAMPUS

EXAMINATION FOR 159.335
OPERATING SYSTEMS AND CONCURRENT PROGRAMMING
Semester One − 2000

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) Draw a diagram showing the structure of a simple microkernel based operating system.

[4 marks]

(b) What is a system call?

[2 marks]

(c) Briefly explain the difference between an operating system that supports multiprogramming and an operating system that does not.

[2 marks]

(d) What is a real time operating system?

[2 marks]

2. (a) What is the wait queue? What can processes in the wait queue be waiting for?

[2 marks]

(b) Give three different mechanisms for communication between processes.

[3 marks]

(c) Briefly describe how an operating system starts running.

[2 marks]

(d) Briefly describe the difference between the UNIX fork system call and the Win32 CreateThread system call.

[3 marks]

Turn over to pg. 3 ...

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

Process	Arrival Time(ms)	Burst Time(ms)
P_1	0	10
P_2	5	5
P_3	10	15
P_4	20	10

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

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

Comment on these results.

[6 marks]

(b) Briefly explain how the time quantum should be chosen for round robin scheduling.

[2 marks]

(c) Briefly explain how scheduling is performed using a multilevel feedback queue.

[2 marks]

4. A five junction roundabout is to be modelled using threads where each thread represents a vehicle. Before a vehicle can move onto the roundabout it must wait until there is no vehicle on the roundabout at the junction it is travelling from. When a vehicle is on the roundabout, it must wait until there is no vehicle ahead before it can proceed. Vehicles move clockwise around the roundabout until they reach the junction they are travelling to.

(a) How many semaphores should be used to solve this problem?
State any assumptions you make about the problem.

[3 marks]

(b) How should these semaphores be initialised?

[2 marks]

(c) Write a C or C++ function with the following prototype for a vehicle thread.

```
void vehicle_thread(int from,int to);
```

where **from** and **to** are the entry and exit junctions.

[5 marks]

Turn over to pg. 4 ...

5. (a) Give an example using two threads to illustrate a race condition.

[3 marks]

(b) A simple operating system allows three files to be open at once and one printer to be used at a time. The following processes are running:

p1: open file, open file, get printer, open file, release printer, close all files.
p2: open file, get printer, release printer, close file.

(i) Give a sequence of execution for p1 and p2 which results in deadlock.

[2 marks]

(ii) Draw a resource allocation diagram to illustrate this deadlock.

[3 marks]

(iii) How could deadlock be avoided in this example.

[2 marks]

6. Give definitions of the following terms.

(a) Priority Scheduling
(b) The Readers/Writers Problem
(c) Deadlock Avoidance
(d) Logical Memory
(e) Page Fault

[10 marks]

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7. (a) A machine uses two level paging; it has a main memory access time of 25ns and a TLB with an access time of 5ns. The miss rate of the TLB is 5%. Calculate the effective memory access time.

[3 marks]

(b) Briefly describe one mechanism for managing free space in a file system.

[3 marks]

(c) Describe how a 256K file is stored on disk using an indexed file system with 4k blocks and the UNIX method of combined indexing. Assume that the first 11 entries in the main index block are directly accessed and the 12^{th} entry uses a single indirect block.

[4 marks]

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