

**MASSEY UNIVERSITY  
ALBANY CAMPUS**

**EXAMINATION FOR  
159.335 OPERATING SYSTEMS AND  
CONCURRENT PROGRAMMING  
Semester One - 2003**

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Time allowed: **THREE (3)** hours

Attempt **ALL SEVEN (7)** questions.

This examination contributes 70% to the final assessment.

**Questions are of equal value**

**Calculators are permitted**

1. (a) Name four significantly different Operating Systems. *[3 marks]*
- (b) What is a distributed Operating System? *[2 marks]*
- (c) Briefly describe how a buffer is used to help transfer data from secondary storage to memory. *[3 marks]*
- (d) How and when is a CPU ever switched from user mode into supervisor mode? *[2 marks]*
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2. (a) What is a device driver? *[2 marks]*
- (b) What could the following code print when run under a UNIX OS?
- ```
for (i=0; i<5; i++) {  
    if (fork ()==0)  
        printf ("%d\n", i);  
}
```
- [3 marks]*
- (c) Will the output from part (b) always be the same each time the program is run? *[1 mark]*
- (d) Briefly explain how a timer is used for process preemption. *[2 marks]*
- (e) One process is waiting on a semaphore and another process is signaling the same semaphore, what states are the two processes in? *[2 marks]*

3. (a) Draw a diagram to illustrate the expected distribution of burst times for a typical set of processes.

[2 marks]

- (b) The following processes are to be scheduled

| <i>Process</i> | <i>Arrival Time(ms)</i> | <i>Burst Time(ms)</i> |
|----------------|-------------------------|-----------------------|
| P <sub>1</sub> | 0                       | 30                    |
| P <sub>2</sub> | 10                      | 20                    |
| P <sub>3</sub> | 30                      | 20                    |
| P <sub>4</sub> | 40                      | 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  $q=10$

Comment on your results.

[6 marks]

- (c) Describe an algorithm that would give the worst possible average waiting time.

[2 marks]

4. (a) Many CPUs have an instruction called “test\_and\_set”, briefly describe this instruction and show how it can be used to solve the critical section problem. *[4 marks]*
- (b) Give a pseudocode solution to the Readers-Writers problem using semaphores. *[4 marks]*
- (c) What is multilevel feedback queue scheduling? *[2 marks]*
5. (a) A Restaurant has two saucepans and two frying pans. Three chefs are cooking.  
Chef 1 needs to use a frying pan and two saucepans.  
Chef 2 needs to use two frying pans and a saucepan.  
Chef 3 needs to use a frying pan and a saucepan.
- At a certain point in time  
Chef 1 is using a frying pan.  
Chef 2 is using a saucepan.  
Chef 3 is using a frying pan.
- i) Draw a Resource Allocation Graph for this system. *[ 2 marks]*
- ii) Is this system in a safe state? Prove using the safety algorithm. *[ 4 marks]*
- iii) Chef 3 decides not to use the saucepan. Is the system in a safe state? Prove. *[2 marks]*
- (b) Briefly describe the difference between deadlock prevention and deadlock avoidance. *[2 marks]*

6. (a) Briefly explain the difference between static and dynamic linking. *[2 marks]*
- (b) Explain the purpose of the 'modified' bit in a page table entry. *[2 marks]*
- (c) Draw diagram to illustrate a three level paging scheme. *[2 marks]*
- (d) A system with two level paging and a Translation Lookaside Buffer (TLB) has an effective access time of 98ns, if the memory access time is 80ns and the TLB access time is 10ns, what is the TLB hit rate? *[3 marks]*
- (e) What is the working set of a process? *[1 mark]*
7. (a) Briefly give an advantage and disadvantage of the each of the following: *[4 marks]*
- i) Indexed Allocation
  - ii) RAID level 0
  - iii) A Logging Filesystem
- (b) A file system uses the UNIX method of combined indexing. It has a block size of 8KB and block numbers are 32 bits. An inode contains 11 direct blocks, one single indirect block and one double indirect block.
- i) How many blocks (including index blocks) would a 1MB file use? *[2 marks]*
  - ii) What is the maximum possible size for a file? *[2 marks]*
- (c) What is an Access Control List? *[2 marks]*

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