University of Swaziland

Faculty of Science
Department of Computer Science

Final Examination, December 2007

Title of Paper: Operating Systems

Course Number: CS442

Time Allowed: Three (3) hours

Instruction: Answer five (5) questions. Every question carries the same maximum mark.

You are reminded that in assessing your work, account will be taken of the accuracy of the material, of the language used and the general quality of expression, together with the layout and presentation of your answer. Remember full answers will usually *define, explain and exemplify*. The use of a calculator is prohibited.

Special Requirement:

none.

This examination paper should not be opened until permission has been granted by the invigilator.

Question 1. [20]
Although they are termed the 'three classic concurrency problems', (which are , of course, *lost update, uncommitted dependency* and *inconsistent analysis*), they can be viewed as successive approximations to the eventual solution of the problem of shared resources.

Explain each problem, and show the progression of solutions to the final solution using semaphores.

Question 2. [20]
Describe the Linux scheduler.

Question 3. [20]
The following Unix commands are executed:
cd /tmp; rm -Rf *; touch file1; touch file2; mkdir diry1; touch diry1/file3

Then these commands were issued, and are shown with their results:
ls -ai
2./   2 ../   2 tmp/

ls -ai /tmp
2./   2../   96577 diry1
12 file1   13 file2

ls -ai /tmp/diry1
96577./   2 ../   96578 file3

Draw the i-node structure created by the operating system.

Question 4. [20]
Describe the operation of paging, with and without Virtual Memory (that is, with and without using MMU).

Apply the Virtual Memory algorithm to the following artificial example:
Page size = 1K, main memory size = 4K.

page table	
virtual page #	frame #
2	3
4	2
3	1
1	0

The instruction in virtual address space location 1024 is a jump to 2048.

Question 5. [20]

The concept of a *process* is central to an operating system. Any concept can have several definitions and a process is no different. Give several definitions of a process, together with supporting description and example (as it says in the rubric).

Which of these definitions would you choose to explain the concept to a first year humanities student (and how would you then explain the concept)?

Question 6. [20]

a) Explain the *magic number* in the boot sector.
b) Differentiate between the *boot sector* and the *MBR*.
c) What is an *ACL*, as in Unix and VAX / VMS?
d) What is a *jiffy* in the Linux kernel?
e) What are the usual criteria for a good *critical region*?

Question 7. [20]

A disk has 4000 cylinders, each with 8 tracks of 512 blocks. A seek takes 1 msec per cylinder moved. If no attempt is made to put the blocks of a file close to each other, two blocks that are logically consecutive (i.e. follow one another in the file) will require an average seek, which takes 5 msec. If, however, the operating system makes an attempt to cluster related blocks, the mean interblock distance can be reduced to 2 cylinders and the seek time reduced to 100 microsec. How long does it take to read a 100 block file in both cases, if the rotational latency is 10 msec and the transfer time is 20 microsec per block?

End of examination paper.