UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

Supplementary Examination, July 2010

Title of paper: **OPERATING SYSTEMS**

Course numbers: **CS442**

Time allowed: 3 hours

Instructions: Answer any 5 out of the 6 question. Each question carries 20 marks.

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Question 1

a) Briefly explain any 6 functions of the operating system. [6]

b)

i. Explain the relation of the operating system level to other levels in the hierarchical structure of the computer. [4]

ii. Describe in detail the kernel-mode and user-mode of the typical operating system. [10]

Question 2

Give a detailed account of paged virtual memory, covering the following concepts: address spaces; pages; page frames; address translation; page faults; and page replacement strategies. [20]

Question 3

a) Define *working set*, *temporal locality* and *spatial locality* and their relevance to operating system design. [5]

b) What is thrashing and what are its main causes? [4]

c) Define the following terms: page fault, segmentation fault and segmentation violation. [3]

d) A purely segmented virtual memory system is required to run a program with 2 code segments (named c0 and c1) and 4 data segments (named d0, d1, d2 and d3). The code segments are 8kB each while the data segments are 12kB each. At a particular time, the following segments are present in memory:

Base RAM address	Segment
0	d0
12288	c1
20480	d3
40960	d1

For each of the following operations, compute the corresponding real addresses, if possible. Otherwise, give reasons:

i. Write to c1, offset 0
ii. Read from d0, offset 3072
iii. Jump to c0, offset 10240
iv. Jump to d3, offset 0
v. Write to d1, offset 2048
vi. Write to d0, offset 12288 [8]

Question 4

a) With the aid of diagrams, describe any 2 disk scheduling policies. [6]

b) Describe the 3 levels of permission (protection modes) that may be assigned to files in Unix. In addition, explain the meaning of the octal protection code: 751. [5]

c) With the aid of diagrams, describe the manner in which Unix orgainizes disk blocks into files using using inodes and multiple levels of indirection. [9]

Question 5

a) Draw a diagram showing the process-states (including suspended states) and the transitions between them. Briefly describe the processes and transitions shown. [9]

b)

i. Define the producer-consumer problem. [3]

ii. Explain how semapores may be used to synchronise 2 processes. In addition, define the 3 operations on semaphores. [8]

Question 6

Write the following program for the Turbo Pascal system running under MS-DOS:

> Initially,the program must store the letters A to Z in an array of bytes. Thereafter, it must wait until the user presses any key. As soon as the key is pressed, the 26 letters in the array must retrieved and displayed on screen. Finally, the program must copy the entire contents of the array into a second array of bytes.

The body of the program (i.e. everything below the BEGIN line), must be written in Intel x86 assembly language. The program must include all pertinent variable and label declarations. It must be well commented. [20]