Dept. Computer Science	**Operating Systems**
Vrije Universiteit	**27.05.2013**

1 What are the two main functions of an operating system? *4pt*

2 What is the difference between kernel mode and user mode? Why is the difference important to an operating system? Name two operations that should be allowed only in kernel mode! *5pt*

3 Threads can be implemented at kernel level and at user level. Give one advantage and one disadvantage of user threads versus kernel threads. *5pt*

4 Give an example of priority inversion and give one solution to this problem. *6pt*

5a What is a critical section? *3pt*

5b Name a synchronization method that is a good fit for read intensive critical sections. *2pt*

5c Sketch how your chosen synchronization method works, what problems it has and discuss this method in terms of performance and fairness! *8pt*

6a What are the states (with respect to scheduling) a process can have and what are the possible transitions from one state to another? Draw a diagram. *6pt*

6b What is a zombie process? *3pt*

7a Give a definition of a deadlock. *3pt*

7b What are the conditions for a deadlock to occur? *5pt*

8 Suppose a network packet arrives at the network card. What happens until the packet is handed over to the network stack? Specifically, we want to know:

1. How does the packet get from the network card to main memory (RAM)?
2. How does the system learn about the packet and how does it handle the event?

5pt

9a What is a Translation look-aside buffer (TLB)? What is the performance benefit of a TLB? *3pt*

9b How is a TLB-miss resolved in a hardware-filled TLB and a software-filled TLB! (Assume a mapping exists.) *4pt*

10a In what situations does the operating system have to make use of page frame replacement? *2pt*

10b How can the Least Recently Used (LRU) page replacement algorithm be implemented? Assume the system provides a referenced (accessed) bit in the page table entries. *6pt*

11 Describe how the path lookup for `/mnt/movies/sci-fi/avatar.avi` on Book-MINIX takes place, where `/mnt/movies` is the mount point of another file system. Specifically, we want to know:

1. How does the path lookup code realize the /mnt/movies directory is a mountpoint?
2. How does the system figure out which file system is mounted on the mountpoint?
3. How does the system find the avatar.avi file in the mounted file system?

8pt

12a Imagine you accidentally deleted your master thesis (plain text) the night before you must hand it in. How would you recover your lost work on the Minix file system. *8pt*

12b Is this always possible? Explain! *4pt*

Grading: *The final grade is calculated by adding the scores per question (maximum: 90 points), and adding 10 bonus points. The maximum total is therefore 100 points.*