Dept. Computer Science	**Operating Systems**
Vrije Universiteit	**04.06.2008**

1a An operating system can be seen as a virtual machine or as a resource manager. Explain the difference. *5pt*

1b Describe the difference between the *raw*, *cooked*, and *cbreak* terminal modes. *5pt*

2a Describe the flow of control as HW interrupts are handled. (Please draw a diagram to support your answer.) *10pt*

2b What is DMA? How does it work, and what are its advantages/disadvantages? *5pt*

3a What is the difference between processes and threads? What information is stored respectively? *5pt*

3b What are the advantages/disadvantages of implementing threads in user versus kernel space? *5pt*

4a What is the purpose of the TSL instruction? Describe the advantages of using this HW-based solution, as opposed to using other SW-based solutions. *5pt*

4b Describe a solution to the Dining Philosophers problem that avoids deadlock and starvation, and that maximizes parallelism. *10pt*

4c Consider the following allocation of resources R1, R2, R3, and R4. Show that this is a safe state. *5pt*

Process	R1	R2	R3	R4
A	4	1	0	1
B	0	2	0	0
C	1	0	1	0
D	1	0	0	1
E	0	0	1	0

Allocated resources

Process	R1	R2	R3	R4
A	1	1	0	0
B	0	1	1	2
C	3	1	0	0
D	0	0	1	1
E	2	1	1	0

Resources still needed

R1	R2	R3	R4
7	4	2	2

Originally available

5a Please describe 3 Disk Arm Scheduling algorithms. *5pt*

5b What kind of disk arm scheduling does MINIX3 use? Please explain why. *5pt*

6a Describe the main characteristics of the a.out executable file format. *5pt*

6b Consider the standard layout of a UNIX file system. Keeping track of available disk blocks and i-nodes is done through bit maps. How do you determine the maximum number of files that a file system can handle? *5pt*

6c Consider again a UNIX file system. How do you determine the maximum file size? *5pt*

7a What is a buffer cache, and why is it useful? Also briefly describe the block write-through strategies used by MS-DOS vs. UNIX. *5pt*

7b In MINIX3, what exactly does the procedure DO_RDWT do (see code on other page)? Please explain each step, and describe the greater context in which this procedure is used. *5pt*

```
11148  PRIVATE int do_rdwt(dp, mp)
11149  struct driver *dp;
11150  message *mp;
11151  {
11153    iovec_t iovec1;
11154    int r, opcode;
11155    phys_bytes phys_addr;
11156
11158    if (mp->COUNT < 0) return(EINVAL);
11159
11161    sys_umap(mp->PROC_NR, D, (vir_bytes) mp->ADDRESS, mp->COUNT, &phys_addr);
11162    if (phys_addr == 0) return(EFAULT);
11163
11165    if ((*dp->dr_prepare)(mp->DEVICE) == NIL_DEV) return(ENXIO);
11166
11168    opcode = mp->m_type == DEV_READ ? DEV_GATHER :  DEV_SCATTER;
11169    iovec1.iov_addr = (vir_bytes) mp->ADDRESS;
11170    iovec1.iov_size = mp->COUNT;
11171
11173    r = (*dp->dr_transfer)(mp->PROC_NR, opcode, mp->POSITION, &iovec1, 1);
11174
11176    return(r == OK ? (mp->COUNT - iovec1.iov_size) :  r);
11177  }
```

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.*