

Last name:

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Student number:

Question 1)

Points:

Maximum points: $1+1+2+2+1+1+1+1=10$

- a) At any given moment, only a single program can be executed. What is the technical term for this operation mode?

- b) What are half multi-user operating systems?

- c) Name one advantage and one drawback of monolithic kernels.

- d) Name one advantage and one drawback of microkernels.

- e) Describe, what an administrator can do with the command `whoami`.

- f) Describe, what an administrator can do with the command `chmod`.

- g) Describe, what an administrator can do with the command `head`.

- h) Describe, what an administrator can do with the command `touch`.

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Question 2)

Points:

Maximum points: $1+1+1,5+1+0,5=5$

- a) Name two rotating magnetic digital data storages.

- b) Name two non-rotating magnetic digital data storages.

- c) Name three benefits of data storage without moving parts compared with data storage with moving parts.

- d) What is random access?

- e) Name one non-persistent data storage.

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Question 3)

Points:

Maximum points: $1+1+2+1=5$

- Draw the structure of a hard disk drive schematically. Explain with your drawing(s) the meaning of the following terms:
 - a) Sector (= Block)
 - b) Track
 - c) Cylinder
 - d) Cluster

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Question 4)

Points:

Maximum points: 6

a) Why causes batch processing an acceleration effect, when multiple tasks are executed?

b) Name an application of batch mode, which is still popular today.

c) What is spooling?

d) What is the name of the quasi-parallel program or process execution?

e) Describe what this command does:

```
$ echo "ERROR" >> /tmp/msg.txt
```

f) What is swapping?

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Question 6)

Points:

Maximum points: $1+1+1+1+1+2=7$

- a) Name one RAID level, which improves the data transfer rate for write.

- b) Name one RAID level, which improves the reliability.

- c) How many drives are allowed to fail in a RAID 0 array without data loss?

- d) How many drives are allowed to fail in a RAID 1 array without data loss?

- e) How many drives are allowed to fail in a RAID 5 array without data loss?

- f) Name one advantage and one drawback of software RAID compared with hardware RAID.

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Question 7)

Points:

Maximum points: $1+3+1+1+2=8$

- a) Which information stores an inode?

- b) Name three examples of metadata in the file system.

- c) What is a cluster in the file system?

- d) How can a UNIX file system (e.g. ext2/3), which does not implement extents, address more than 12 clusters?

- e) Name one advantage and one drawback of small clusters in the file system compared with large clusters.

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Question 8)

Points:

Maximum points: $1+1+1+1+2+2+1=9$

x86-CPU's contain 4 privilege levels („rings“) for processes.

a) In which ring runs the kernel of the operating system?

b) In which ring run the applications of the users?

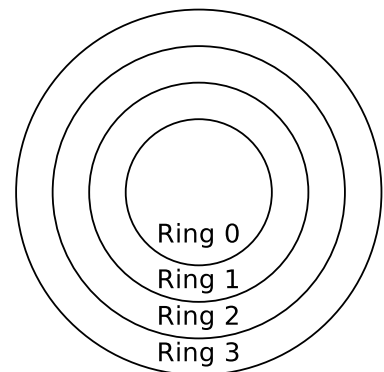
c) Processes of which ring have full access to the hardware?

d) What is a system call?

e) What is a context switch?

f) Name two reasons why user mode processes should not call system calls directly.

g) What alternatives exist, if user mode processes should not call system calls directly?



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Question 9)

Points:

Maximum points: 4+2+1+1+2=10

- a) A parent process (PID = 100) with the characteristics, described in the table below, creates a child process (PID = 200) by using the system call `fork()`. Enter the four missing values into the table.

	Parent Process	Child Process
PPID	99	
PID	100	200
UID	25	
Return code of <code>fork()</code>		

- b) Explain the difference between preemptive and non-preemptive scheduling.
- c) Name one drawback of preemptive scheduling.
- d) Name one drawback of non-preemptive scheduling.
- e) Name four scheduling strategies, for which the CPU runtime (= execution time) of the processes are not required be known.
(Note: This means that only scheduling methods are correct here, which can be used in practice under realistic conditions.)

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Question 10)

Points:

Maximum points: 10

- a) Why does the process control block not store all process context information?
- b) What is the task of the dispatcher?
- c) What is the task of the scheduler?
- d) What is a zombie process?
- e) What is the task of the process control block?
- f) What is the PID?
- g) What is the PPID?
- h) Name (or describe) one useful application for the command `sed`.
- i) Name (or describe) one useful application for the command `awk`.
- j) What is `init` and what is its task?

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Question 11)

Points:

Maximum points: 10

- a) What must be considered, when inter-process communication via shared memory segments is used?
- b) According to which principle operate message queues?
 Round Robin LIFO FIFO SJF LJF
- c) How many processes can communicate with each other via a pipe?
- d) What is the effect, when a process tries to write data into a pipe without free capacity?
- e) Which two different types of pipes exist?
- f) Which two different types of sockets exist?
- g) What is a critical section?
- h) What is a race condition?
- i) Communication via shared memory segments works...
 memory-based stream-based
 object-based message-based
- j) Communication via sockets works...
 memory-based stream-based
 object-based message-based