

Last name:

First name:

Student number:

Question 2)

Points:

Maximum points: 2+2+2=6

a) Describe the difference in the structure of a monolithic kernel compared with a microkernel.

b) Name one advantage and one drawback of monolithic kernels.

c) Name one advantage and one drawback of microkernels.

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Question 3)

Points:

Maximum points: 2+3+1=6

- a) Explain the two file entries „.“ and „..“ in the output of `ls`?

```
$ mkdir new_directory
$ cd new_directory
$ ls -l --all --size --human-readable
insgesamt 8,0K
4,0K drwxr-xr-x  2 bnc users 4,0K Jul 12 11:03 .
4,0K drwxr-xr-x 119 bnc users 4,0K Jul 12 11:03 ..
```

- b) Explain the permissions of the file `convert_script.py`.

```
$ ls -l --all --size --human-readable
insgesamt 16K
4,0K drwxr-xr-x  2 bnc users 4,0K Jul 12 09:14 .
4,0K drwxr-xr-x 119 bnc users 4,0K Jul 12 09:13 ..
8,0K -rwxr-xr--  1 bnc users 7,0K Jul 12 09:22 convert_script.py
```

(Note: Describe which operations the different users/groups are allowed to carry out with the file.)

- c) Which command is used to modify the permissions of files?

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Question 5)

Points:

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

A HDD provides these information:

IBM Travelstar	MODEL: DBCA-204860 E182115 T
RATED: 5V 500mA	MADE IN THAILAND BY IBM STORAGE
P/N: 21L9510 4090 MB	16NOV99
FRU: 22L0018 MLC:F41941	(7944 CYL. 16 HEADS. 63 SEC/T)

- a) Calculate the capacity of one surface area of one disk of the HDD.
(Provide the calculation steps!)

*Note: The number of cylinders (CYL) is equal with the number of tracks per disc.
The size of each sector (SEC) is 512 Byte.*

- b) Calculate the capacity of one track of the HDD.
(Provide the calculation steps!)

- c) Calculate the total capacity of the HDD.
(Provide the calculation steps!)

- d) How many discs contains the HDD? *Note: Each disk has two surface areas.*
(Provide the calculation steps!)

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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: 10

The Buddy method for allocating memory to processes shall be used for a memory with a capacity of 1024kB. Perform the provided operations and give the occupancy state of the memory after each operation.

	0	128	256	384	512	640	768	896	1024
Initial state	1024 KB								
65 KB request => A									
30 KB request => B									
94 KB request => C									
34 KB request => D									
136 KB request => E									
Free D									
Free B									
Free C									
Free A									
Free E									

(!!! CAUTION !!! With the second template you can save time, if you want to try it all over again. Please mark clearly which one of your solutions shall be considered during the correction!)

	0	128	256	384	512	640	768	896	1024
Initial state	1024 KB								
65 KB request => A									
30 KB request => B									
94 KB request => C									
34 KB request => D									
136 KB request => E									
Free D									
Free B									
Free C									
Free A									
Free E									

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Question 9)

Points:

Maximum points: 7

- a) Name (or describe) one useful application for the command **sed**.

- b) Name (or describe) one useful application for the command **awk**.

- c) Describe what this command does:

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

- d) Describe what this command does:
(*Note: Focus on a difference with the command from subtask c.*)

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

- e) Name (or describe) one useful application for the command **head**.

- f) Name (or describe) one useful application for the command **tail**.

- g) Name (or describe) one useful application for the command **grep**.

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Question 10)

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?

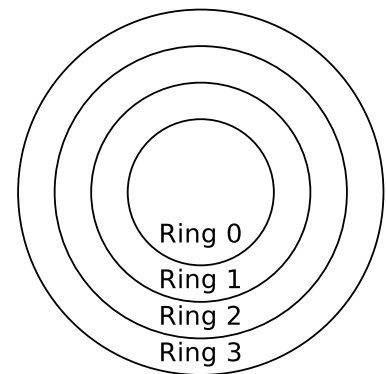
c) Processes of which ring have full access to the hardware?

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 11)

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	
Rückgabewert von <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 12)

Points:

Maximum points: 4

a) Does a deadlock occur?

Perform the deadlock detection with matrices.

Existing resource vektor = (4 8 6 6 5)

Current allocation matrix = $\begin{bmatrix} 0 & 2 & 1 & 0 & 0 \\ 2 & 3 & 1 & 0 & 4 \\ 1 & 0 & 2 & 1 & 1 \end{bmatrix}$

Request matrix = $\begin{bmatrix} 3 & 3 & 2 & 4 & 5 \\ 0 & 3 & 1 & 4 & 0 \\ 0 & 2 & 3 & 5 & 4 \end{bmatrix}$