Exercise Sheet 10

Exercise 1 (Virtualization and Emulation)

1. What is the difference between emulation and virtualization?
2. Name a drawback of emulation against virtualization.
3. How works partitioning?
4. What component of a computer distributes the physical resources to the virtual machines in the partitioning virtualization concept?
5. Which sort of computer systems usually implement partitioning?

   ☐ Mobiltelefone ☐ Desktop PCs ☐ Mainframes ☐ Workstations
6. How works application virtualization?
7. Name an example for application virtualization.
8. How works full virtualization?
9. What is the function of the Virtual Machine Monitor (VMM)?
10. Where runs the Virtual Machine Monitor (VMM)?

    ☐ The VMM runs *hosted* as an application in the host operating system.
    ☐ The VMM runs *bare metal* and replaces the host operating system.
11. Can all physical hardware resources be virtualized when full virtualization is used? If this is not possible, give an example where it does not work and explain your answer.
12. How many privilege levels contain x86-compatible CPUs?
13. In which privilege level runs the VMM?
14. In which privilege level run the VMs?
15. How get VMs access to hardware resources when full virtualization is used?
16. Name an example of a full virtualization implementation.
17. How works paravirtualization?
18. Where runs the hypervisor when paravirtualization is used?

    ☐ The hypervisor runs *hosted* as an application in the host operating system.
    ☐ The hypervisor runs *bare metal* and replaces the host operating system.

19. In which privilege level runs the hypervisor when paravirtualization is used?
20. Why is for paravirtualization a host operating system required?
21. What is an unprivileged domain (Dom0) of Xen?
22. What is a Domain 0 (Dom0) of Xen?
23. Name a drawback of paravirtualization.
24. In which way have the privilege levels of x86-compatible CPUs been modified to implement hardware virtualization?
25. Name an advantage of hardware virtualization.
26. How works storage operating system-level virtualization (containers/jails)?
27. Name a drawback of operating system-level virtualization (containers/jails).
28. Name an example of an operating system-level virtualization (containers/jails) implementation.
29. How works storage virtualization?
30. How works network virtualization via Virtual Local Area Networks (VLAN)?

Exercise 2 (Shell Scripts, Loops)

1. Program a shell script, which generates with loops this output:

```
1
22
333
4444
55555
```

2. Program a shell script, which generates with loops this output:

```
1
12
123
1234
12345
```

3. Program a shell script, which generates with loops this output:

```
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|  |_
```

```
| | |_
| | | |_
| | | | |_
```

4. Program a shell script, which generates with loops this output:

```
*
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****
*****
```

5. Program a shell script, which generates with loops this output:

```
*
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*****
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*
```

6. Program a shell script, which generates with loops this output:

```
    *
   ***
  *****
 *******
*********
```