

Exercise Sheet 3

Exercise 1 (Computer Architecture)

1. Name the three components the CPU contains.
2. Name the three digital bus systems each computer system contains according to the Von Neumann architecture.
3. Name the tasks that are carried out by the three digital bus systems.
4. Explain what the Front Side Bus (FSB) is.
5. Give the names of the two components the chipset contains.
6. Name the tasks of the components of the chipset.

Exercise 2 (Input/Output Devices)

1. Give the names of the two groups of Input/Output devices for computer systems that can be distinguished according to their minimum transfer unit.
2. Describe the different operating principles of the groups of subtask 1.
3. Name two examples for each group from subtask 1.
4. Name three possible ways for processes to read data from Input/Output devices.
5. Name a benefit and a drawback for each possible way from subtask 4.

Exercise 3 (Digital Data Storage)

1. Name one mechanic digital data storage.
2. Name two rotating magnetic digital data storages.
3. Name two non-rotating magnetic digital data storages.
4. Name four benefits of data storage without moving parts compared with data storage with moving parts.
5. Explain what random access is.
6. Name one non-persistent data storage.

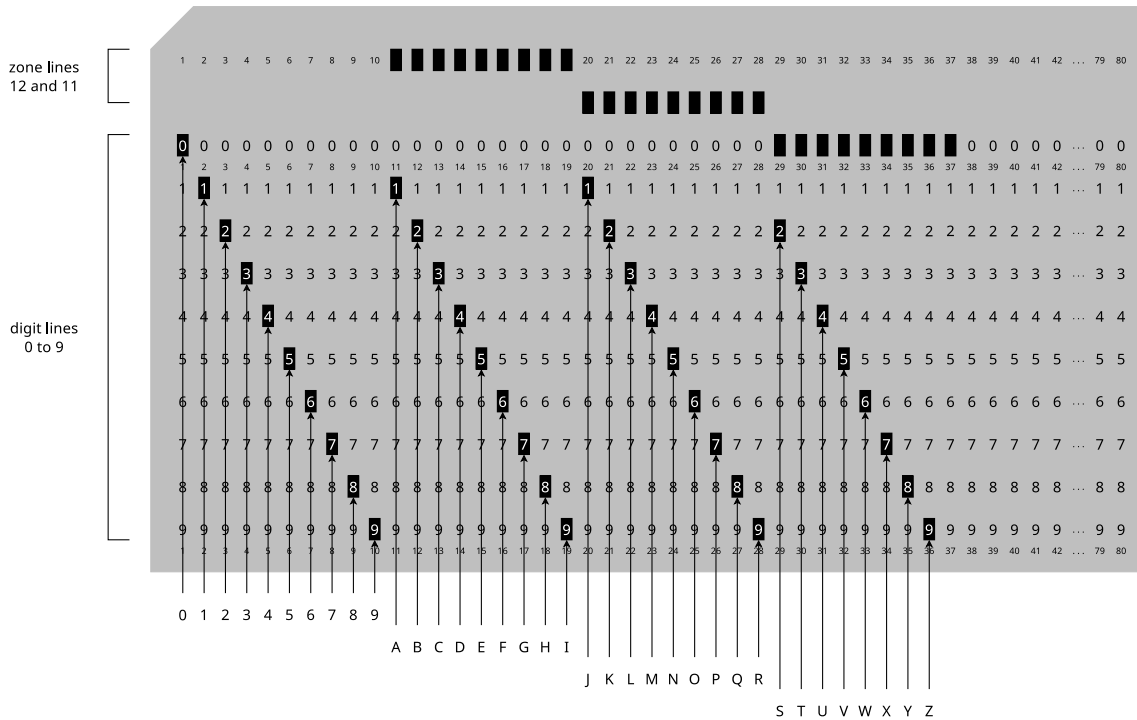
7. The storage of computer systems is distinguished into the categories primary, secondary, and tertiary storage. Give the name of the category or categories the CPU can access directly.
8. Give the name of the category or categories of subtask 7 the CPU can only access via a controller.
9. Name two examples for each category of subtask 7.
10. Name the two categories of tertiary storage.
11. Describe the two categories of subtask 10.

Exercise 4 (Encoding of data and data storage)

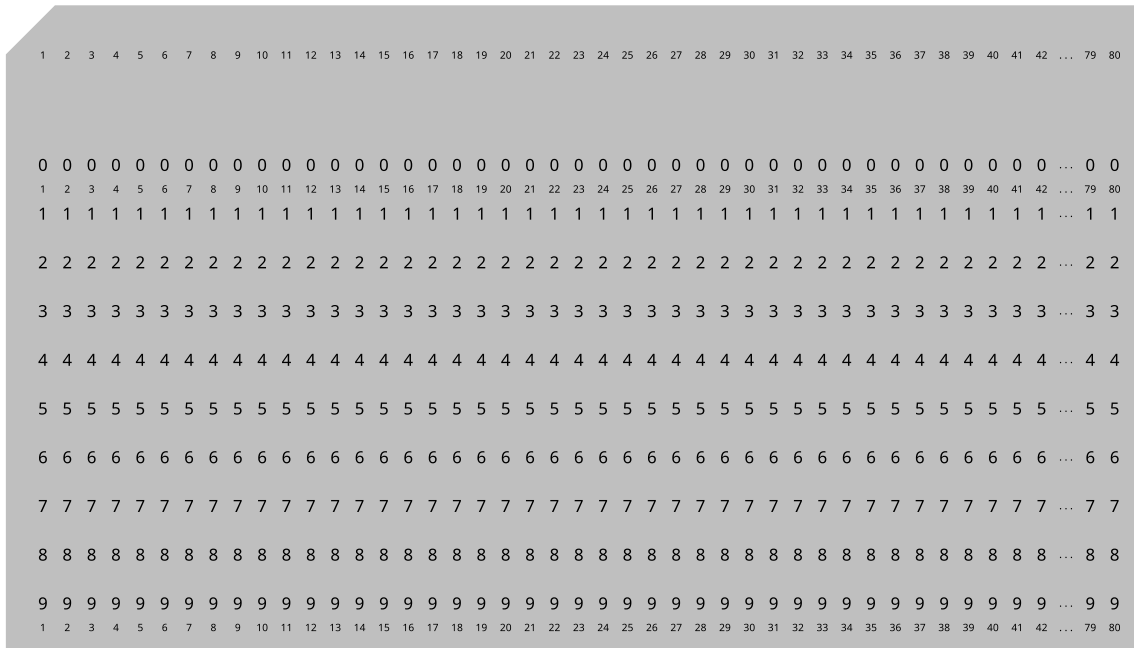
An exciting example of how digital data can be persistently stored is punched cards, which were used until the 1970s. Each punch card usually represents one line of program code with 80 characters. Each column corresponds to one character. The numbers and letters are encoded with the digit lines 0 to 9 and with the so-called zone lines 11 and 12. The digit line 0 is sometimes called zone line 10 in the literature. The digits 0 to 9 are encoded directly in the corresponding lines. The coding of the letters, on the other hand, is as follows:

- A to I encoded by punching the zone line 12 and the digit line 1 to 9.
- J to R encoded by punching the zone line 11 and the digit line 1 to 9.
- S to Z encoded in digit line 0 (= zone line 10) and in zone lines 2 to 9.

Encoding lowercase letters, umlauts, negative numbers, and special characters is possible by various other hole combinations but is irrelevant here. The following figure shows the principle of encoding the digits 0 to 9 and the letters.



Record the character string **OPERATING SYSTEMS** on the punch card.



Note: There are punch card simulators such as <https://www.masswerk.at/keypunch>

Exercise 5 (Write policies)

1. Name the two basic cache write policies.

2. Name the cache write policy that may cause inconsistencies.
3. Name the cache write policy that causes a lower system performance.
4. Name the cache write policy that uses so called dirty bits.
5. Explain for what reason dirty bits are used.

Exercise 6 (Permissions and Links)

1. Which command can be used to specify that all new created files have this permissions: `-r--r--r--`

Attention! If you executed the command, you should fix your permissions as a next step. Otherwise it will be not so comfortable for you to work in your home directory.

2. Create in your home directory a directory with the name `BTS_Links`. Navigate to the new directory and try to erase the entry `..`.
3. Create in the directory `BTS_Links`...
 - an empty file `Original`.
 - a hard link `HardLink`, which points to the file `Original`.
 - a symbolic link `SymbLink`, which points to the file `Original`.
4. Check the inodes of the file `Original` and of both links via `ls -li`.
5. Is it possible to copy hard links? Try to copy the link.
6. Is it possible to copy symbolic links? Try to copy the link.
7. Check the result of your copying via `ls -li`. What are your conclusions?
8. The so called *link count* of files indicates the number of directory entries, which refer to an inode. What indicates the link count of directories and what influences the link count of directories?

Exercise 7 (Wildcards and Filters)

1. Create in your home directory a directory `DiverseDateien`. Navigate to this directory and create these files:

```
abcdefg.bat  cdata3.sav  cdata7.sav  datei3.txt  datei7.txt
abcxyz.bat   cdata4.sav  datei10.txt datei4.txt  datei8.txt
cdata1.sav   cdata5.sav  datei1.txt  datei5.txt  datei9.txt
cdata2.sav   cdata6.sav  datei2.txt  datei6.txt  xyzabc.bat
```

2. Which command can be used to print out a list of all files in the directory, whose filenames start with the pattern `datei`?
3. Which command can be used to print out a list of all files in the directory, whose filenames contain the pattern `cd`?
4. Which command can be used to print out a list of the files `cdata2.sav`, ..., `cdata5.sav` in the directory?
5. Which command can be used to print out a list of all files in the directory, whose filenames contain the characters `c` or `z` on position 3?
6. Which command can be used to print out a list of all files in the directory, whose filenames start with the character `a` and end with the character `t` and also contain the character `c` on any position?
7. Which command can be used to print out a list of the files `datei1.txt`, ..., `datei9.txt` in the directory but without the files `datei3.txt` and `datei4.txt`.