

# 1. Banking

**Exercise:** There are 3 banks with 3 different **interest rates**. For example:

Bank	Interest rate
Bank 1	1.5%
Bank 2	2.0%
Bank 3	2.5%

We deposit *1000€* into each bank. In how many years to we have *2000€* in total in each bank? Create **algorithms** to tackle the problem and consider the possible **advantages and disadvantages** of such algorithms.

- Describe the **banking security** in terms of choosing the network **topology** or **data encryption** to defend against hackers. What are the types of hackers? # 2. IP and Network
- 1. Describe the **IPv4** and **IPv6** addresses.
- 2. Describe the history of the **internet** - Arpanet.
- 3. What is a **subnet mask**?
- 4. What's the role of **internet providers**?
- 5. **IP addresses** - understand the structure of an IP address and detect an incorrect one. # 3. Text processing

**Exercise:** convert a message, such as *'Ahoj, ako sa mas?'* to a **bit map** and display its result. Additionally, estimate the size of such a digital picture.

**\*Hint:** in order to estimate the size of a **digital bit map**, we have that  $S = \text{color depth} * \text{dimensions}$ . We truncate the output to the width of 8 pixels. E.g.:  $(122)_{10} = (1111010)_2 \implies (01111010)_2$

Define the terms: **ASCII**, **Enlarged ACII**, **Unicode**

# 4. Data compilation and data encryption

What is **data compilation**? How do we compile a text image to a standardised image format?

1. Define the term **data encryption** and what does it incorporate.
2. Why is **data encryption** significant?
3. What is a **public** and a **private** key?
4. What are some of the most common methods of data **encryption**?
5. What is **data decryption**?

**Symmetric and asymmetric data encryption** sourced document link.

# 5. Databases

**Exercise:** A company provides a **database** with the names and the surnames of their employees. Create an algorithm that will create a database of proper **email** addresses in the format: **name.surname@company.com**.

1. What is the **structure** of an email address?
2. Define what **DNS** stands for and explain the term.
3. Discuss some of the **potential risks** of cyber security.
4. **GDPR** threats.

# 6. PC network

1. What are the **pros and cons** of internet-based services and service providers?
2. **Client server** vs. **Peer-to-peer**
3. Types of connections based on the **lengths**.
4. What is a **networking protocol**? Describe some of it type, such as **HTTP(s)**, **FTP**, **IMAP**, **SMT**, **POP3**, **TCP**, etc.
5. Describe the types of **network topology** and briefly discuss their pros and cons.
6. Describe the term **network traffic**. What are the types of **connections**?
7. Explain **IPS providers**.

Sourced document titled **Internet** link.

## 7. Message decryption

**Exercise:** an encrypted message in the form of a sequence of ASCII values is given, e.g.: 122 65 87 88 67 ... XX. We assume the message to consist **English/Slovak** words exclusively. Find the numerical value of XX (so the word has a meaning) and create a **bit map** to represent the message as an image.

1. What is **color depth** and how do we measure it?
2. Define the term **image compression**.

## 8. Cards of guests

**Exercise:** we are given an **.xls database** with the full names of guests. Create a program which will generate **invitation cards** to every visitor with the credentials obtained from the database.

1. What are **computer graphics**?
2. What are **vector** and **raster graphics**? How do they differ?
3. What kind of printers would you use to **print** the guests?

**Computer graphics** sourced document link.

## 9. Search engine and web browser

Describe the components of a **search engine**: 1. **Spider** 2. **Index** (indexing) 3. **Search and retrieval** component Provide examples of **search engines**.

Mention and describe the types of search engines (SE): 1. **Free text** SE 2. **Directory-based** SE 3. **Meta** SE

Mention several examples of **web browser** and describe the function of a **web browser**. Sourced document link.

**Exercise:** Create a program that will generate a random number from the interval  $< 1; 1023 >$ . Then, the program will try to guess the number, only being given whether the desired number is **greater** or **smaller** than the current user's input. Compose the algorithm.

## 10. Computer security

1. Describe the main types of **anti-viruses**.
2. What are some of the **protocols** that ensure network computer security?
3. Define the terms: **anti-spyware**, **anti-malware**.
4. Which protocol ensures the update of an **anti-virus** software on a local machine?  
> **TL;DR** → TCP-IP/ISO layers.

**Exercise:** Detect errors in a table of  $8 \times 8$  bits by **bit parity**. Propose methods to fix the table.

## 11. Number base systems

1. **Conversions** between different number base systems: **decimal**, **octal**, **decimal**, **hexadecimal**.
2. **Conversion** of numerical values obtained from number base systems to **ASCII**, **Unicode**, etc.

**Exercise:** you are given a set of **coordinates** in binary values. Find the real location of the **map**.

## 12. Digital representation of colours

**Exercise 1:** convert an RGB value from **binary** to **decimal/hexadecimal** format.

1. What do **RGB** and **CMYK** stand for?
2. What are their uses in modern electronics?
3. How do they differ? Provide examples.

Describe the following computer parts: **sockets**, **monitor**, **processing unit**, **I/O devices**.

**Exercise 2:** Katka has a colour palette. She wants to write a text onto each paper. We need to determine whether the text be in black or white.

**Hint:** consider the *brightness formula*  $C = (R \times 299) + (G \times 587) + (B \times 144) \div 1000$ , where  $R, G, B$  represent respective RGB decimal values. If  $127 \geq C \implies$  we use a **white** colour and vice versa.

### 13. Find a secret place

We are given an **image** which depicts 2 solid colours. We need to find a real place on the **map** based on the finding of our conversion; *image*  $\rightarrow$  *place*.

**Hint:** we observe 2 colours in the standard RGB format:  $(R_1, G_1, B_1) \wedge (R_2, G_2, B_2)$ . Then we have the following coordinates.  $R_1^\circ G_1' B_1''$  of geographical **latitude** (N/S) and  $R_2^\circ G_2' B_2''$  of geographical **longitude** (W/E)

Example of an **image**:



Figure 1: demo

### 14. Digitizing of sound

1. Describe the aspects of **digitizing of sound**. Sourced document link.
2. Calculate the **file size** and the **download time** of various audio files.

Provide examples of suitable **audio software** for various professional jobs (based on the budget). Adduce several **audio format file extensions** and describe the differences.

### 15. Nodes and finding the shortest distance

1. What are **hash functions** and how do we use them?
2. How may **hash function** be used with various **networking protocols**?

**Exercise:** find the **shortest distance** from  $N$  nodes in a planar figure with the distances (between them) and allowed speeds ascribed. For instance, find the shortest distance and/or the shortest route in terms of the total amount of time between the node  $A$  and the node  $E$ , hence  $A \rightarrow E$ .

### 16. File size of images given the colour depth

We disregard any **file compression**!

**Exercise 1:** Suppose a picture of  $256 \times 160$  pixels and 4096 colours. Calculate the file size in MB.

**Exercise 2:** Suppose a picture of  $650 \times 1150$  pixels and 16384 colours. Calculate the file size in Mb.

Paper about **digitizing of an image** link.

### 17. Operating systems (OSs)

1. Describe the term **UI - user interface** of an OS.
2. How does an OS manage tasks concerning **local data management**?
3. How does an OS manage **external devices**?
4. Describe the aspects of security management of an OS.

Compare and contrast the most common types of OS: **macOS**, **Windows**, **Linux**. Discuss why would someone prefer one over another? Adduce examples from **professional jobs**, etc. - Discuss the relation between **software** and **hardware**.

**Von Neumann architecture** sourced document link.

### 18. Linux and its distributions

1. Explain the basics of the **Gnu/Linux** operating systems.
2. What is the **Linux Kernel**?
3. What's the primary use of **Linux** devices?
4. Adduce examples with different **Linux distributions**.

## 19. E-commerce

1. What does the term **e-commerce** stand for?
2. What are the possible **pros & cons** of it?
  - What are **YouTube** copyright laws and why do we need them?
3. Describe the **pros & cons** of internet banking.

Describe the processes how data is **distributed**. How do we ensure secure **data transmissions**? What is **data compression** and why is it essential for modern technologies?

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## Python exercises

List of Python exercises:

*1, 5, 8, 9, 10, 11, 13, 14, 17, 18, 20, 22, 25, 26, 27, 30, ~~31~~, 34, 37, 39, 41, 42, 43, 45, 46, 47, 48, 56, 58, 59, 62, 64*

## Exemplary solutions from practical exercises

1. Extra solutions;
2. TBD;