

# Komponenta výukového serveru TI NP-úplné problémy 2

Component of Learning Server for  
Theoretical Computer Science  
NP-complete problems 2

BAKALÁŘSKÁ PRÁCE

**Phat Tran Dai**

# Abstrakt

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At.

**Klíčová slova:** Lorem, ipsum, dolor, sit, amet,, consectetur, adipiscing, elit,, sed, do, eiusmod, tempor, incididunt, ut, labore, et, dolore, magnam, aliquam, quaerat.

# Abstract

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

**Keywords:** Lorem, ipsum, dolor, sit, amet,, consectetur, adipiscing, elit,, sed, do, eiusmod, tempor, incididunt, ut, labore, et, dolore, magnam, aliquam, quaerat.

## Poděkování

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim ad eaue doleamus animo, cum corpore dolemus, fieri.

# Seznam použitých zkratek a symbolů

WTF	– What the fuck
DPC	– Do $x^2$ pice
KDPC	– Kurva do pice → aaaah

# Obsah

<b>Úvod</b>	<b>10</b>
<b>1 Heading Level 1</b>	<b>12</b>
1.1 Heading Level 2 . . . . .	12
<b>2 OFDM - Orthogonal Frequency Division Multiplexing</b>	<b>14</b>
2.1 Introduction . . . . .	14
2.2 Subheading Level 2 . . . . .	15
2.3 Prokázání netranzitivity . . . . .	15
2.4 Subheading Level 2 . . . . .	15
2.4.1 Subheading Level 3 . . . . .	15
<b>3 Heading Level 1</b>	<b>17</b>
3.1 Subheading Level 2 . . . . .	17
3.2 Subheading Level 2 . . . . .	18
3.3 Subheading Level 2 . . . . .	19
<b>4 Heading Level 1</b>	<b>20</b>
4.1 Heading Level 2 . . . . .	20
4.1.1 Heading Level 2 . . . . .	20
4.2 Heading Level 3 . . . . .	20
<b>5 Heading 5</b>	<b>21</b>
<b>6 Závěr</b>	<b>23</b>
<b>7 Literatura</b>	<b>25</b>
<b>A Qsort implementation</b>	<b>28</b>
<b>B Shit table</b>	<b>29</b>
<b>C OpenGL Shader Compilation</b>	<b>30</b>
<b>D C# code</b>	<b>32</b>

# Seznam obrázků

1. Some random data visualisation . . . . . 16

# Seznam tabulek

1. A looong table . . . . .	17
2. A simple table . . . . .	18

# Seznam algoritmů

1. Binary Search . . . . .	28
2. Variable Assignment . . . . .	29



# Seznam výpisů

1. Computer program in C language . . . . .	14
2. Simple SQL query . . . . .	14
3. C++ method for GLSL shader compilation . . . . .	30
4. Computer program in C# language . . . . .	32

# Úvod

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum defuturum, quas natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus. Sed iure Mucius. Ego autem mirari satis non queo unde hoc sit tam.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequae doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum defuturum, quas

natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus. Sed iure Mucius. Ego autem mirari satis non queo unde hoc sit tam insolens domesticarum rerum fastidium. Non est omnino hic docendi locus; sed ita prorsus existimo, neque eum Torquatum, qui hoc primus cognomen invenerit, aut torquem illum hosti detraxisse, ut aliquam ex eo est consecutus? – Laudem et caritatem, quae sunt vitae sine metu degendae praesidia firmissima. – Filium morte multavit. – Si sine causa, nollem me ab eo delectari, quod ista Platonis, Aristoteli, Theophrasti orationis ornamenta neglexerit. Nam illud quidem physici, credere aliquid esse minimum, quod profecto numquam putavisset, si a Polyaeo, familiari suo, geometrica discere maluisset quam illum etiam ipsum dedocere. Sol Democrito magnus videtur, quippe homini erudito in geometriaque perfecto, huic pedalis fortasse; tantum enim esse omnino in nostris poetis aut inertissimae segnitiae est aut fastidii delicatissimi. Mihi quidem videtur, inermis ac nudus est. Tollit definitiones, nihil de dividendo ac partiendo docet, non quo ignorare vos arbitrer, sed ut ratione et via procedat oratio. Quaerimus igitur, quid sit extremum et ultimum bonorum, quod omnium philosophorum sententia tale debet esse.

# Kapitola 1

# Heading Level 1

QQ hello ja fi diofjosdfodsjsodslsdlsdkjflskdjklffffffffffffffffff kldkjksdfljsdlfljjjj.j..jl  
jem k a v o.

$$f(x) = y$$

$$\begin{pmatrix} 1 & 2 & \dots & 10 \\ 2 & 2 & \dots & 10 \\ \vdots & \vdots & \ddots & \vdots \\ 10 & 10 & \dots & 10 \end{pmatrix}$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat voluptatem. Ut enim aequaleam animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

## 1.1 Heading Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

$$\Omega = \{(2,1), (2,1), (5,1), (5,1),$$
$$(2,4), (2,4), (5,4), (5,4),$$
$$(2,4), (2,4), (5,4), (5,4),$$
$$(2,4), (2,4), (5,4), (5,4)\}$$

Velikost pravděpodobnostního prostoru je  $|\Omega| = 16$ . Z rozepsané  $\Omega$  vidíme, že počet případů, kdy kostka  $B$  vyhraje nad  $A$  je vyšší (10) než počet, kdy prohraje (6). Pravděpodobnost vypočteme jako:

$$P(B > A) = \frac{2 + 4 \cdot 2}{|\Omega|} = \frac{10}{16} = \underline{\underline{0.625}}$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequale doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguique possit, augeri amplificarique non possit.

At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum defuturum, quas natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus. Sed iure Mucius. Ego autem mirari satis non queo unde hoc sit tam insolens domesticarum rerum fastidium. Non est omnino hic docendi locus; sed ita prorsus existimo, neque eum Torquatum, qui hoc primus cognomen invenerit, aut torquem illum hosti detraxisse, ut aliquam ex eo est consecutus? – Laudem et caritatem, quae sunt vitae.

## Kapitola 2

# OFDM - Orthogonal Frequency Division Multiplexing

## 2.1 Introduction

In `refKapitola 2.1`, we see how to turn Sections into Chapters. And in `refkapitole 2.1`, it is done manually.

$$\leq \pm$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do. [1]. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do. [2].

$$\sum_{i=1}^n i = 1 + 2 + 3 + \dots + n$$

Code snippet in C programming language:

---

```
1  #include <stdio.h>
2
3  int main() {
4      printf("hello, world!\n");
5      return 0;
6  }
```

---

Výpis 1: Computer program in C language

More simple language, for example SQL:

---

```
1  SELECT
2      c.customer_id,
3      c.fname,
4      c.lname,
5      c.email
6  FROM customer c
7  WHERE EXISTS (
8      SELECT *
9      FROM purchase p
10     WHERE p.customer_id = c.customer_id
11 )
```

---

Výpis 2: Simple SQL query

## 2.2 Subheading Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat. [3]

$$\begin{bmatrix} 1 & * & * \\ * & 1 & * \\ * & * & 1 \end{bmatrix}$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri.

## 2.3 Prokázání netranzitivity

První úkolem je ukázat, že vztahy mezi kostkami nejsou tranzitivní, to znamená, že vztahy mezi kostkami jsou tzv. cyklické<sup>1</sup> Tvrdíme totiž, že platí  $B > A$ ,  $C > B$  a současně  $A > C$ . To znamená, že žádná kostka není „nejlepší“ ve všech případech.

Pro každou dvojici kostek vypočítáme pravděpodobnost vítězství jedné kostky nad druhou, konkrétně  $P(B > A)$ ,  $P(C > B)$  a  $P(A > C)$ , a ověříme, že všechny tyto pravděpodobnosti jsou větší než  $\frac{1}{2}$ .

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquid aeternum et infinitum impendere.

## 2.4 Subheading Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat.

---

```

1  #show "ArtosFlow": name => box[
2    #box(image(
3      "logo.svg",
4      height: 0.7em,
5    ))
6    #name
7  ]
8
9  This report is embedded in the
10 ArtosFlow project. ArtosFlow is a
11 project of the Artos Institute.
```

---

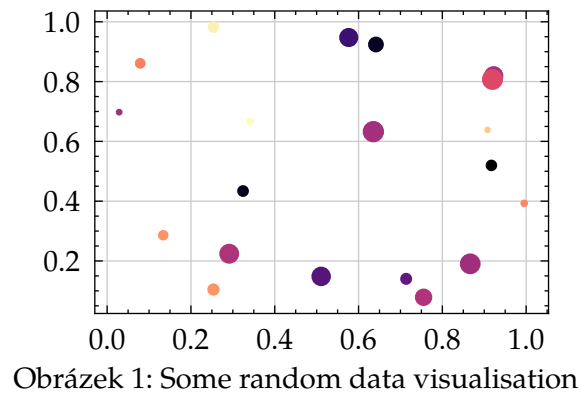
### 2.4.1 Subheading Level 3

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat voluptatem. Ut enim aequi doleamus

---

<sup>1</sup>Wikipedia, *Intransitivity*: <https://en.wikipedia.org/wiki/Intransitivity>

animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.



Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequale doleamus animo, cum corpore dolemus, fieri.



Kapitola 3

Heading Level 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

3.1 Subheading Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut.

Index	Value
1	10
2	11
3	12
4	13
1	10
2	11
3	12
4	13
1	10
2	11
3	12
4	13
1	10
2	11
3	12
4	13
1	10
2	11

Index	Value
3	12
4	13
1	10
2	11
3	12
4	13
1	10
2	11
3	12
4	13
1	10
2	11
3	12
4	13
1	10
2	11
3	12
4	13
1	10
2	11
3	12
4	13

Tabulka 1: A looong table

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat.

### 3.2 Subheading Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguique possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et.

Shape	Area
Circle	$\pi r^2$
Square	$a^2$
Rectangle	$ab$

Tabulka 2: A simple table

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

Definujeme:

$$\phi := \frac{1 + \sqrt{5}}{2} \quad (1)$$

Pomocí rovnice 1, dostaneme:

$$F_n = \left\lfloor \frac{1}{\sqrt{5}} \phi^n \right\rfloor$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aeque doleamus animo, cum corpore dolemus, fieri.

$$E = \sqrt{m_0^2 + p^2}$$

$$\approx 125 \text{ GeV}$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

$$E = mc^2 \quad (2.1)$$

$$= \sqrt{p^2 c^2 + m^2 c^4} \quad (2.2)$$

### 3.3 Subheading Level 2

Skalární součin dvou vektorů  $\vec{a}$  a  $\vec{b}$  je znázorněn rovnicí 3.

$$\begin{aligned} \langle a, b \rangle &= \vec{a} \cdot \vec{b} \\ &= a_1 b_1 + a_2 b_2 + \dots a_n b_n \\ &= \sum_{i=1}^n a_i b_i. \end{aligned} \quad (3.1)$$

Notace sumy v rovnici 3.1 je užitečný způsob zápisu skalárního součinu dvou vektorů.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

## Kapitola 4

# Heading Level 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

### 4.1 Heading Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

#### 4.1.1 Heading Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

### 4.2 Heading Level 3

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri. [1]

    Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequi doleamus animo, cum corpore dolemus, fieri. [4]

## Kapitola 5

# Heading 5

Jelikož základ nehomogenní funkce je roven jedné, počet výskytů (násobnost) tohoto základu v multimnožině kořenu charakteristické rovnice je roven jedné a největší exponent  $n$ -ka nehomogenní funkce je taktéž roven jedné, je tvar obecného partikulárního řešení rekurentní rovnice  $p_n$  roven:

$$\begin{aligned} p_n^{(p)} &= n^1(\beta_1 n^1 + \beta_0)1^n = n(\beta_1 n + \beta_0) = \beta_1 n^2 + \beta_0 n \\ p_n^{(p)} &= \varphi n^2 + \gamma n \quad (\gamma = \beta_0, \varphi = \beta_1). \end{aligned}$$

Neznámé  $\gamma$  a  $\varphi$  nalezneme substitucí členů  $p_n$  v původní rekurentní rovnici:

$$p_n = 3p_{n-1} - 2p_{n-2} - 10n.$$

partikulárním řešením  $p_n^{(p)}$  a vyřešíme soustavu dvou rovnic (dvě kvůli dvěma neznámým), kde si za  $n$  zvolíme jakékoliv čísla z  $\mathbb{N}_0$ .

$$p_n \leftarrow p_n^{(p)}:$$

$$p_n^{(p)} = 3p_{n-1}^{(p)} - 2p_{n-2}^{(p)} - 10n$$

$$\begin{aligned} \varphi n^2 + \gamma n &= 3(\varphi(n-1)^2 + \gamma(n-1)) \\ &\quad - 2(\varphi(n-2)^2 + \gamma(n-2)) - 10n \\ \varphi n^2 + \gamma n &= 3(\varphi(n^2 - 2n + 1) + \gamma n - \gamma) \\ &\quad - 2(\varphi(n^2 - 4n + 4) + \gamma n - 2\gamma) - 10n \\ \varphi n^2 + \gamma n &= 3(\varphi n^2 - 2\varphi n + \varphi + \gamma n - \gamma) \\ &\quad - 2(\varphi n^2 - 4\varphi n + 4\varphi + \gamma n - 2\gamma) - 10n \\ \varphi n^2 + \gamma n &= 3\varphi n^2 - 6\varphi n + 3\varphi + 3\gamma n - 3\gamma \\ &\quad - 2\varphi n^2 + 8\varphi n - 8\varphi - 2\gamma n + 4\gamma - 10n \\ \varphi n^2 + \gamma n &= \varphi n^2 + 2\varphi n - 5\varphi + \gamma n + \gamma - 10n \\ 0 &= 2\varphi n - 5\varphi + \gamma - 10n \end{aligned}$$

Nyní si za  $n$  zvolíme například nulu a jedničku.

$$n = 0: \quad 0 = 2\varphi \cdot 0 - 5\varphi + \gamma - 10 \cdot 0$$

$$n = 1: \quad 0 = 2\varphi \cdot 1 - 5\varphi + \gamma - 10 \cdot 1$$

$$\begin{cases} 0 = -5\varphi + \gamma \\ 0 = 2\varphi - 5\varphi + \gamma - 10 \end{cases}$$

$$\begin{cases} 0 = \gamma - 5\varphi \\ 10 = \gamma - 3\varphi \end{cases}$$

$$\left(\begin{array}{cc|c} 1 & -5 & 0 \\ 1 & -3 & 10 \end{array}\right) \xrightarrow{R_2 \leftarrow R_2 - R_1} \left(\begin{array}{cc|c} 1 & -5 & 0 \\ 0 & 2 & 10 \end{array}\right) \xrightarrow{R_2 \leftarrow \frac{1}{2}R_2} \left(\begin{array}{cc|c} 1 & -5 & 0 \\ 0 & 1 & 5 \end{array}\right)$$

$$\varphi = 5$$

$$\gamma - 5 \cdot \varphi = 0 \Leftrightarrow \gamma = 25$$

Tudíž řešení partikulární rovnice  $p_n^{(p)}$  je:

$$p_n^{(p)} = \varphi n^2 + \gamma n$$

$$\underline{p_n^{(p)} = 5n^2 + 25n.}$$

# Závěr

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequaleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequaleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequaleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum defuturum, quas natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus. Sed iure Mucius. Ego autem mirari satis non queo unde hoc sit tam.

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim aequaleamus animo, cum corpore dolemus, fieri tamen permagna accessio potest, si aliquod aeternum et infinitum impendere malum nobis opinemur. Quod idem licet transferre in voluptatem, ut postea variari voluptas distinguere possit, augeri amplificarique non possit. At etiam Athenis, ut e patre audiebam facete et urbane Stoicos irridente, statua est in quo a nobis philosophia defensa et collaudata est, cum id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum defuturum, quas natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus.

Sed iure Mucius. Ego autem mirari satis non queo unde hoc sit tam insolens domesticarum rerum fastidium. Non est omnino hic docendi locus; sed ita prorsus existimo, neque eum Torquatum, qui hoc primus cognomen invenerit, aut torquem illum hosti detraxisse, ut aliquam ex eo est consecutus? – Laudem et caritatem, quae sunt vitae sine metu degendae praesidia firmissima. – Filium morte multavit. – Si sine causa, nollem me ab eo delectari, quod ista Platonis, Aristoteli, Theophrasti orationis ornamenta neglexerit. Nam illud quidem physici, credere aliquid esse minimum, quod profecto numquam putavisset, si a Polyaeno, familiari suo, geometrica discere maluisset quam illum etiam ipsum dedocere. Sol Democrito magnus videtur, quippe homini erudito in geometriaque perfecto, huic pedalis fortasse; tantum enim esse omnino in nostris poetis aut inertissimae segnitiae est aut fastidii delicatissimi. Mihi quidem videtur, inermis ac nudus est. Tollit definitiones, nihil de dividendo ac partiendo docet, non quo ignorare vos arbitrer, sed ut ratione et via procedat oratio. Quaerimus igitur, quid sit extremum et ultimum bonorum, quod omnium philosophorum sententia tale debet esse.



# Literatura

- [1] MUNROE, Randall. *Types of Editors* [online]. 12. březen 2014. Dostupné z: <https://xkcd.com/1341/>
- [2] GÜNTHER-HAUG, Barbara. *Den Boden unter den Füßen verlieren*. B.m.: MVG, 2020.
- [3] STEYERL, Hito. *Drill*. 20. červen 2019
- [4] MEHTA, Jiten a Eric KINNEAR. *Boost Performance and Security with Modern Networking* [online]. 26. červen 2020 [cit. 2020-09-17]. Dostupné z: <https://developer.apple.com/videos/play/wwdc2020/10111/>
- [5] PREKAS, George, Marios KOGIAS a Edouard BUGNION. ZygOS: Achieving Low Tail Latency for Microsecond-Scale Networked Tasks. In: *Proceedings of the 26th Symposium on Operating Systems Principles* [online]. B.m.: Association for Computing Machinery, 2017, s. 325–341. Dostupné z: doi:10.1145/3132747.3132780
- [6] OMAROVA, Saule a Graham STEELE. There's a Lot We Still Don't Know About Libra. *The New York Times* [online]. 2019. Dostupné z: <https://www.nytimes.com/2019/11/04/opinion/facebook-libra-cryptocurrency.html>
- [7] DONNE, John. *The "Anniversaries" and the "Epicedes and Obsequies"*. B.m.: Indiana University Press, 1995. The Variorum Edition of the Poetry of John Donne.
- [8] BROWN, George C., ed. A Swedish Traveller in Early Wisconsin: The Observations of Fredrika Bremer. *Wisconsin Magazine of History*. 2. vyd. 1978, 61–62.
- [9] In: J. K. ROWLING *Harry Potter and the Order of the Phoenix*. cca. 2003, s. 135–139.
- [10] MÄDJE, Laurenz. *Tokenization of + and - with scientific notation* [online]. 18. červenec 2020. Dostupné z: <https://github.com/typst/typstc/issues/3>
- [11] *Terminator 2: Judgment Day*. Carolco Pictures; Pacific Western Productions; Lightstorm Entertainment; Le Studio Canal+ S.A. 1. červenec 1991.
- [12] *Conspiracy Theories and Interior Design*. In.: Universal Television; Sony Pictures Television; Krasnoff Foster Productions; Harmonious Claptrap; Russo Brothers Film. 18. listopad 2010.
- [13] *The wire*. Blown Deadline Productions. 2002.
- [14] DOAN, T. D., D. B. TRAN THOAI a Hartmut HAUG. Kinetics and luminescence of the excitations of a nonequilibrium polariton condensate. *Physical Review B* [online]. 2020, 102(16), 165126–165139. Dostupné z: doi:10.1103/PhysRevB.102.165126
- [15] JERRENTROP, Andreas, Tobias MUELLER, Ulrich GLOWALLA, Meike HERDER, Nadine HENRICH, Andreas NEUBAUER a Juergen R. SCHAEFER. Teaching

- medicine with the help of "Dr. House". *PLoS ONE* [online]. 2018, **13**(3). Dostupné z: [doi:10.1371/journal.pone.0193972](https://doi.org/10.1371/journal.pone.0193972)
- [16] *Informational plaque about Jacoby's 1967 photos*. B.m.: Stiftung Reinbeckhallen. 2020
- [17] *L'oiseau rare, de l'hirondelle au kakapo* [online]. 18. prosinec 2020 [cit. 2020-11-04]. Dostupné z: <https://www.museedesconfluences.fr/fr/evenements/1%E2%80%99oiseau-rare-de-1%E2%80%99hirondelle-au-kakapo>
- [18] DUVAL, Fred. *Renaissance, Les Déracinés*. 1. vyd. Přel. EMEM a Fred BLANCHARD. B.m.: Dargaud, 2018.
- [19] MOORE, Edward F. *Gedanken-experiments on sequential machines*. B.m.: NBS. duben 1956. *Annals of Mathematics Studies*
- [20] SILVER, Nate. Trump's claim to have won Georgia is highly dubious. No network has called it. He's only ahead by 2.5 points there, and the outstanding votes are mostly mail votes in very blue counties, likely very Democratic. Biden may even be a slight favorite there. In: [online]. 4. listopad 2020. Dostupné z: <https://twitter.com/NateSilver538/status/1323889051037028353>
- [21] PEDBOST, Marven F., Trilleen POMALGU, Chris LINTOTT, Nora EISNER a Belinda NICHOLSON. *Defining the Really Habitable Zone* [online]. 2020. Dostupné z: <https://arxiv.org/abs/2003.13722>
- [22] ISHKUR. *Ishkur's Guide to Electronic Music* [online]. [cit. 2020-11-12]. Dostupné z: <http://www.techno.org/electronic-music-guide/>
- [23] MATTERMOST. Mattermost Privacy Policy. *Policies* [online]. [cit. 2020-11-29]. Dostupné z: <https://mattermost.com/privacy-policy/>
- [24] WORTH, Jon. *Jon Worth Euroblog* [online]. Dostupné z: <https://jonworth.eu/>
- [25] PROKOPOV, Nikita. It is fast or it is wrong. *tonsky.me* [online]. 29. prosinec 2018. Dostupné z: <https://tonsky.me/blog/slow-wrong/>
- [26] UNITED NATIONS DEVELOPMENT PROGRAMME. *Human Development Report 2019* [online]. 2019. Dostupné z: <http://hdr.undp.org/sites/default/files/hdr2019.pdf>
- [27] BARROWS, Miellyn Fitzwater. Audio Descriptions. In: [online]. 7. únor 2017. Dostupné z: <https://www.20k.org/episodes/audio>
- [28] *authoritative* [online]. nedatováno [cit. 2020-11-29]. Dostupné z: <https://dictionary.cambridge.org/dictionary/english/authoritative>
- [29] *Logician* [online]. nedatováno [cit. 2019-12-02]. Dostupné z: <http://image-net.org/api/text/wordnet.structure.hyponym?wnid=n10269785>
- [30] INTERNET ENGINEERING TASK FORCE. *Secret Key Transaction Authentication for DNS* [online]. 2000. Dostupné z: <https://tools.ietf.org/html/rfc2845>
- [31] *Roe v. Wade*. 1973
- [32] *Freedom of Information Act*. 1967
- [33] JOHN. Celebrating over five million users, a quarter million daily actives, and over five years of dedicated user support. *Overleaf Blog* [online]. 8. listo-

pad 2019. Dostupné z: <https://de.overleaf.com/blog/celebrating-over-five-million-users-and-a-quarter-million-daily-actives>

- [34] PEPE, Alberto. *How many scholarly articles are written in LaTeX?* [online]. 21. únor 2017. Dostupné z: doi:[10.22541/au.148771883.35456290](https://doi.org/10.22541/au.148771883.35456290)

## Příloha A

# Qsort implementation

Implementation is in Haskell.

---

```
1 quicksort [] = []
2 quicksort (p:xs) = (quicksort lesser) ++ [p] ++ (quicksort greater)
3   where
4     lesser = filter (< p) xs
5     greater = filter (>= p) xs
```

---

Yes. Very cool.

---

### Algorithm 1: Binary Search

---

```
1: procedure BINARY-SEARCH( $A, n, v$ )
2:   ▷ Initialize the search range
3:    $l \leftarrow 1$ 
4:    $r \leftarrow n$ 
5:
6:   while  $l \leq r$  do
7:      $mid \leftarrow \text{floor}(\frac{l+r}{2})$ 
8:     if  $A[mid] < v$  then
9:        $l \leftarrow m + 1$ 
10:    else if  $A[mid] > v$  then
11:       $r \leftarrow m - 1$ 
12:    else
13:      return  $m$ 
14:    end
15:  end
16:  return null
17: end
```

---

## Příloha B

# Shit table

A	B
B	C
C	D

---

**Algorithm 2: Variable Assignment**

---

1:  $x \leftarrow y$

---

## Příloha C

# OpenGL Shader Compilation

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magnam aliquam quaerat.

---

```
1 unsigned int OpenGLShader::Compile(
2     const std::unordered_map<unsigned int, std::string>& sources
3 ) const
4 {
5     EG_PROFILE_FUNCTION();
6
7     EG_CORE_ASSERT(sources.size() >= 0 && sources.size() <= 3,
8         "Can only have three shader sources \
9         (vertex, geometry, fragment)!");
10
11     unsigned int program;
12     EG_OPENGL_CALL(program = glCreateProgram());
13
14     std::vector<unsigned int> shaders(sources.size());
15     for (const auto& [type, source] : sources)
16     {
17         auto shader = CompileSource(type, source);
18         shaders.push_back(shader);
19         EG_OPENGL_CALL(glAttachShader(program, shader));
20     }
21
22     EG_OPENGL_CALL(glLinkProgram(program));
23
24     int status;
25     EG_OPENGL_CALL(glGetProgramiv(program, GL_LINK_STATUS, &status));
26     if (status == GL_FALSE)
27     {
28         int length;
29         EG_OPENGL_CALL(glGetProgramiv(
30             program, GL_INFO_LOG_LENGTH, &length));
31
32         std::vector<char> message(length);
33         EG_OPENGL_CALL(glGetProgramInfoLog(
34             m_RendererID, length, &length, message.data()));
35
36         EG_OPENGL_CALL(glDeleteShader(program));
37         for (auto shader : shaders)
38         {
39             EG_OPENGL_CALL(glDeleteShader(shader));
40         }
41         EG_CORE_ERROR("{} ", message.data());
42         EG_CORE_ASSERT(false, "Shader compilation failed!");
43         return 0;
44     }
45
46     EG_OPENGL_CALL(glValidateProgram(program));
47     for (auto shader : shaders)
```

---

---

```
48     {  
49         EG_OPENGL_CALL(glDeleteShader(shader));  
50     }  
51  
52     return program;  
53 }
```

---

Výpis 3: C++ method for GLSL shader compilation

## Příloha D

# C# code

---

```
1 using System.Diagnostics;
2 using System.Security.Claims;
3 using CoworkingApp.Models;
4 using CoworkingApp.Models.Misc;
5 using CoworkingApp.Models.ViewModels;
6 using CoworkingApp.Services.Repositories;
7 using Microsoft.AspNetCore.Authorization;
8 using Microsoft.AspNetCore.Mvc;
9
10 namespace CoworkingApp.Controllers.ViewControllers;
11
12 public class HomeController
13 {
14     IWorkspaceRepository workspaceRepository,
15     ICoworkingCenterRepository coworkingCenterRepository,
16     IReservationRepository reservationRepository,
17     IUserRepository userRepository
18 }
19 : Controller
20 {
21     [HttpGet]
22     public async Task<IActionResult> Index()
23     {
24         var workspaces = await workspaceRepository.GetWorkspaces(new ()
25         {
26             HasPricing = true,
27             IncludePricings = true,
28             IncludeStatus = true,
29         });
30
31         var coworkingCenters = await
32 coworkingCenterRepository.GetCenters(
33             new CoworkingCenterFilter());
34
35         return View(new HomeIndexViewModel()
36         {
37             Workspaces = workspaces,
38             CoworkingCenters = coworkingCenters
39         });
40     }
41
42     [HttpGet]
43     [Authorize]
44     public async Task<IActionResult> Dashboard(
45         [FromQuery] ReservationSort reservationSort =
46 ReservationSort.None)
47     {
48         var userId = User.GetUserId();
49
50         if (userId == null)
51         {
52         }
```

---



---

```
50         return Unauthorized(new { message = "User not found" });
51     }
52
53     var reservations = await reservationRepository
54         .GetReservations(new ReservationsFilter
55         {
56             CustomerId = userId,
57             IsCancelled = false,
58             IncludeWorkspace = true,
59             Sort = reservationSort,
60         });
61
62     var user = (await userRepository.GetUsers(new UserFilter
63     {
64         UserId = userId
65     })).Single();
66
67     return View(new HomeDashboardViewModel
68     {
69         User = user,
70         Reservations = reservations,
71         ReservationSort = reservationSort,
72     });
73 }
74
75 [HttpGet]
76 public async Task<IActionResult> Privacy()
77 {
78     return View();
79 }
80
81 [ResponseCache(
82     Duration = 0,
83     Location = ResponseCacheLocation.None, NoStore = true)]
84 public IActionResult Error()
85 {
86     return View(new ErrorViewModel
87     {
88         RequestId = Activity.Current?.Id ??
89         HttpContext.TraceIdentifier
90     });
91 }
```

---

Výpis 4: Computer program in C# language