ALBERT-LUDWIGS-
UNIVERSITÄT FREIBURG

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Exercise Sheet 0 for the Tutorial
Computer Science Theory (Bridging Course)

This exercise shall give you an impression on what skills you'll need to survive within the computer science theory bridging course. While we expect you to have learned these abilities within your bachelor program, you should be able to acquire them by yourself within a short amount of time if you haven't. Possible knowledge gaps will not be filled throughout this course.

If you should consider these tasks as too easy and search for pitfalls, there aren't any (given we did not fail). This exercise is intended to be easy.

Exercise 1: General Logic

Negate the following statements, try to avoid trivial solutions wherever possible:

Example: All computer science students are aware of the principles of logic.

Trivial Solution: Not all computer science students are aware of the principles of logic.

Intended Solution: There is at least one computer science student unaware of the principles of logic.

a) It's raining.

b) It's not raining.

c) It's sunny and it's not raining.

d) It's sunny or it's not sunny.

e) Everybody is wearing a red T-shirt today.

f) Somebody is wearing a hat.

Exercise 2: Induction

Prove the following statements using induction:

Example: $\forall n \in \mathbb{N} : \sum_{i=0}^{n} i = \frac{n(n+1)}{2}$

We will prove by induction that, for all $n \in \mathbb{N}$,

$$\sum_{i=0}^{n} i = \frac{n(n+1)}{2}$$

The statement holds for $n = 0$:

$$\sum_{i=0}^{0} i = 0 \qquad \frac{0(0+1)}{2} = 0 \checkmark$$

Let $k \in \mathbb{N}$ be given and suppose that the statement we're proving is true for that $n = k$. Then the statement holds for $n = k + 1$ as well:

$$\begin{aligned} \sum_{i=0}^{k+1} i &= k + 1 + \sum_{i=0}^{k} i \\ &= k + 1 + \frac{k(k+1)}{2} && \text{(by induction hypothesis)} \\ &= \frac{2k + 2 + k(k+1)}{2} \\ &= \frac{(k+1)(k+2)}{2} \end{aligned}$$

Conclusion: By the principle of induction, the statement is proved for all $n \in N$.

a) Every Number in $\mathbb{N}$ has a successor. You may use the recursive definition of $\mathbb{N}$:

$$0 \in \mathbb{N} \qquad n \in \mathbb{N} \Rightarrow n + 1 \in \mathbb{N}$$

b) $\forall n \in \mathbb{N} : \sum_{i=0}^{n} m = m(n+1)$

Exercise 3: Pseudocode

Calculate the return values of the following functions:

a)
```
a := 5;
b := 8;
return b;
```

b)
```
a := 5;
b := 7;
c := b;
return c;
```

c)
```
a := 5;
b := a;
return b;
```

d)
```
a := 5;
b := a + 2;
return b;
```

e)
```
a := 5;
b := 7;
c := b;
b := a;
return c;
```

f)
```
a := 5;
a := a + 2;
return a;
```

g)
```
a := 0;
b := 0;
c := 5;
while a <= c do
  b := b + a;
  a := a + 1;
od;
return b;
```

h)
```
a := 2;
b := 3;
c := b;
b := a;
return c;
```

i)
```
a := 6;
b := 2;
return b;
```

Exercise 4: What are you here for?

As this is the first bridging course ever, we'd like you to reflect on a few points. Please help us improving the course by submitting your answers with your solution.

- What expectations do you have in regards to this course? What are your personal goals?
- What do you expect from the lecturers?
- How much time are you willing to invest into the course? How much time do you actually have?
- What's the best way of dealing with issues throughout the course? Think of cultural differences or issues with the script's content or exercises.

Please typeset your solution with TeX and send the resulting PDF to

csBridgeSolutions@david-zschocke.de

before attending your individual tutorial.