

Examination for Analysis of Algorithms

Exercise 1

```
i=1; j=0;
while (i<n)
if (i>j) j=j+5;
else while (j>i+7) i=i/2;
```

1. Draw the program flow graph,
2. mark a spanning tree and
3. identify the fundamental cycles!
4. How many non-trivial quantities must be determined for a complete analysis, and
5. which ones do you suggest for analysis?

Exercise 2

For an arbitrary algorithm that searches a sorted array using comparisons, let C^+ denote the number of comparisons for a successful search and C^- for an unsuccessful search (elements and gaps occur with equal probability).

How do C^+ and C^- asymptotically relate to each other?

Exercise 3

In a monastery, monks can either pray or work under the following conditions: Each hour, they can either pray or work, but they cannot work for more than two consecutive hours. Each hour of prayer earns two *Bräuros* and each hour of work earns one *Bräuro*.

- Determine the OGF $M(z)$ for the number of ways to earn exactly n Bräuros.
- What is the exponential growth (i.e., for which a does $M_n \asymp a^n$)?

Exercise 4

Find an asymptotic estimate for f_n , where

$$f(z) = \frac{e^z \sqrt{1+2z}}{\sqrt{1-3z}}$$

is the generating function for f_n .