# Les 1 huiswerk

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## 1 Opgave 1

- $\log_2(N) + 0.01N$
- $2\log_2(N)$
- $0.5N\log_2(0.5N)$
- $3N^2 + 4N$
- $N^3 + 801N$

## 2 Opgave 2

A. $O(N)$:

$$\frac{500}{100} = 5$$
$$0.4 \cdot 5 = 2\text{ms}$$

B. $O(N^2)$:

$$100 \cdot 100 \text{ operations}$$
$$500 \cdot 500 = 250\,000 \text{ operations}$$
$$\frac{250\,000}{10\,000} = 25$$
$$25 \cdot 0.4 = 10\text{ms}$$

C. $O(N^3)$:

$$100^3 = 1\,000\,000$$
$$500^3 = 125\,000\,000$$
$$\frac{125\,000\,000}{1\,000\,000} = 125$$
$$125 \cdot 0.4 = 50\text{ms}$$

# 3 Opgave 3

With $60\,000\text{ms} = 60\text{s}$

A. $O(N)$:

$$t(N) = k \cdot N$$
$$t(100) = 0.5\text{ms}$$
$$0.5 = k \cdot 100$$
$$k = \frac{0.5}{100} = 0.005$$
$$60\,000 = 0.005 \cdot N$$
$$N = \frac{60\,000}{0.005} = 12\,000\,000 \text{ operations}$$

B. $O(N^2)$:

$$t(N) = k \cdot N^2$$
$$t(100) = 0.5\text{ms}$$
$$0.5 = k \cdot 100^2$$
$$k = \frac{0.5}{10\,000} = 5 \times 10^{-5}$$
$$60\,000 = 5 \times 10^{-5} \cdot N^2$$
$$N^2 = \frac{60\,000}{5 \times 10^{-5}} = 1\,200\,000\,000$$
$$N = \sqrt{1\,200\,000\,000} = 34\,641 \text{ operations}$$

C. $O(N^3)$:

$$t(N) = k \cdot N^3$$
$$t(100) = 0.5\text{ms}$$
$$0.5 = k \cdot 100^3$$
$$k = \frac{0.5}{100^3} = 5 \times 10^{-7}$$
$$60\,000 = 5 \times 10^{-7} \cdot N^3$$
$$N^3 = \frac{60\,000}{5 \times 10^{-7}} = 120\,000\,000\,000$$
$$N = \sqrt[3]{120\,000\,000\,000} = 4932 \text{ operations}$$

# 4 Opgave 4

$O(N)$

# 5 Opgave 5

A. $O(N)$

B. $O(\frac{N}{2}) = O(N)$

C. $O(N^2)$

D. $O(N) + O(N) = O(N)$

E. $O(N^3)$

F. $O(N^2)$

G. $O(N^5)$

H. $O(\log_2 N)$

# 6 Opgave 6

Main function: $O(N^3)$ Functie: $O(y)$ Functie2: $O(3 \log_2 x)$
$y := N^2 - i$ and $x := N$
gives $O(N^3 \log_2 N)$

# 7 Opgave 7

A. $O(N)$ groeit minder snel dan $O(N^2)$

B. $O(\log_2 N)$ plateaut

C. $\log_2 N$ plateaut, $N$ gaat recht, $N \log_2 N$ gaat hoger dan $N$

# 8 Opgave 8

B. $\log_2 1024 = 10, \log_2 2048 = 11$

C. $x = 2^4 = 16$

D. $x = 2^{10} = 1024$

# 9 Opgave 9

A. $x^2 = 10x$ doorkruist op $x = 10$. $x^2 = 1\,000x$ doorkruist op $x = 1\,000$. $\alpha$ moet minimaal $x$ zijn en wordt dan versimpelt naar $x^2 + \alpha$.

B. $x = e^{-W_{-1} - \log 2/100} \approx 996$

C. $x = e^{-W_{-1} - \log 2/100} \approx 996$