

## Exercise 2

**Task 1** (Fast Fourier Transform)

(a) Compute  $(x + 2) \cdot (2x - 1)$  with the FFT.

**Task 2**

Let  $A, B \subseteq \{1, \dots, 10n\}$  be sets with  $|A| = |B| = n$ . We want to compute

$$C := \{a + b : a \in A, b \in B\}$$

and the number of possibilities to write  $c \in C$  as a sum of elements in  $A$  and  $B$ . Specify an algorithm that solves the problem in time  $\mathcal{O}(n \log n)$ .

**Task 3**

Let  $x$  and  $y$  be natural numbers in binary representation. Decide in NC, whether  $x < y$ .

**Task 4**

Let  $x$  and  $y$  be natural numbers in binary representation. Compute the subtraction  $x - y$  in NC, where  $x - y = 0$  if  $x < y$ .

**Task 5**

Compute the number of paths between two nodes in a directed acyclic graph in NC.