# IN3200/IN4200 Exercise Set 2

## Exercise 1

Write a simple C program that illustrates the speed advantages of reading and writing binary data files, compared with using ASCII data files.

## Exercise 2

Write a simple C program that compares the following hand-coded copy operation between two arrays

```
for (i=0; i<n; i++) b[i]=a[i]
```

with using the standard `memcpy` function.

## Exercise 3

Write a C program to do the following 3D numerical calculation:

- Allocate two 3D arrays `v` and `u`, both of dimension $n_x \times n_y \times n_z$.
- Initialize the values of array `v` by the following formula:

$$v_{i,j,k} = 2.0 + \sin\left(\frac{i \cdot j \cdot k \cdot \pi}{(n_x - 1) \cdot (n_y - 1) \cdot (n_z - 1)}\right),$$

  where $v_{i,j,k}$ denotes `v[i][j][k]`.
- Initialize the entire array of `u` with zeros.

- Carry out the following computation for a prescribed number of iterations. During each iteration:

  $$u_{i,j,k} = v_{i,j,k} + \frac{v_{i-1,j,k} + v_{i,j-1,k} + v_{i,j,k-1} - 6v_{i,j,k} + v_{i+1,j,k} + v_{i,j+1,k} + v_{i,j,k+1}}{6}$$

  for $1 \leq i \leq n_x - 2, 1 \leq j \leq n_y - 2, 1 \leq k \leq n_z - 2$. Copy the content of `u` to `v` before the next iteration.

- Deallocate the two 3D arrays `v` and `u`.

# Exercise 4

How to measure the actual FLOPS rate achieved by your 3D solver above?