Short HW 5: **The Derivative on Histogram Space**

Course: Physics 017, *Linear Algebra for Physics* (S22)
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Due by: **Thursday**, May 5

Note that this short assignment is due by class on Thursday. You have only *two days* to do it. This should be quick, I recommend doing it right after class on Tuesday.

The discrete **backward derivative** D acting on a discretized function $|f\rangle$ with 'histogram' components f^i is

$$(Df)^i = \langle e_i|D|f\rangle = \frac{f^i - f^{i-1}}{\Delta x} \ . \tag{0.1}$$

Assume that the discretized function space is N-dimensional, so that i runs from 1 to N. For this problem, assume **periodic boundary conditions** where $f^{N+1} = f^1$ and $f^0 = f^N$.

1 Backward Derivative for Periodic Boundary Conditions

For the case $N = 4$, explicitly write D as an $N \times N$ matrix.