PS 703106
Exercise 5
Group 4:

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Hardware: Nvidia GTX 960

Performance:
With use of workgroups and local memory:

Workgroup size	N	Kernel Zeit [ms]	MFLOP/s
3+2	10	6	250
3+2	100	92	18350
3+2	1000	4014	483
8+2	10	7 ms	235
8+2	100	79	21376
8+2	1000	2480	782
18+2	20	12	1067
18+2	100	73	23188
18+2	1000	2232	870

Without workgroups:

N	Kernel time [ms]	MFLOP/s
10	6	240
100	72	23462
1000	1623	1196

The validation of the workgroup-version was always negative, indicating that there was still some error in the kernel.

The MFLOPs are calculated thusly:

center: 4 (indices) -> 1 times on stencil
get temp left/right/up/down: 4 * 2 (indices) = 8
update temp: 7 + 2 (indices) = 9

flop for each part:
center: (T-1) * 4
get temp l/r/u/d: (T-1) * ((N * N * 8) - ((4 * N) + 4)) //((4 * N) + 4) = border
update temp: (T-1) * N * N * 9

complete flop calculation:
(((T-1) * 4) + ((T-1) * ((N * N * 8) - ((4 * N) + 4))) + ((T-1) * N * N * 9))

Which is most assuredly wrong in some way, because it frequently returns a negative value

Performance:
The tuning of the workgroup size has great effect on the performance of the kernel, however it is likely that the performance of a correctly written kernel should have beaten that of the one without the workgroups. This way only a nonlinear change in performance among the workgroup sizes is observable. Theoretically an immense speedup should have been observable, as the calculation of every pixel has its memory time from 5 slow accesses to global memory, reduced to 1 global and 4 fast local accesses.