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Exercises for
Computer Architecture
Summer Semester 2019

Exercise Sheet 6

Discussion starts from Wednesday, June 5, 2019

6.1 OpenCL - Theory

Consider the following code fragments:

1	`memoryObjects[0] = clCreateBuffer(context, CL_MEM_READ_ONLY | CL_MEM_ALLOC_HOST_PTR, buffSize, NULL, &err);`
2	`cl_int* inputA = (cl_int*)clEnqueueMapBuffer(commandQueue, memoryObjects[0], CL_TRUE, CL_MAP_WRITE, 0, bufferSize, 0, NULL, NULL, &errorNumber);`
3	`int i = get_global_id(0);`

Please explain the effect of each code fragment.

6.2 OpenCL - Extension

Please modify the 'Hello_World_OpenCL' program, which you already know from last week's exercise, according to the following assignments:

(a) Extend the 'Hello_World_OpenCL' program, so that three input values and two output values are generated instead of two input values and one output value (subsequently termed W1, W2, W3, O1 and O2).

(b) Modify the program, so that cl_float is used instead of cl_int.

(c) Modify the program, so that two distinct kernels are executed successively:

   (i) The first kernel should compute (W1+W2+W3)*(W1-W2-W3) and store the result in O1.

   (ii) The second kernel should multiply the decimal places of a number with its integer value for each of the three inputs and store the sum of these results in O2. For 337,4284, this is 337*0,4284=144,3708.

6.3 OpenCL - Additional Assignment

Please modify the 'Hello_World_OpenCL' program, which you already know from last week's exercise, according to the following assignments:

(a) Create an cl_int array.

(b) Fill the array with random values between 0 and 255.

(c) Create a kernel, which re-calculates the value for each field. In the course of this, the value should be modified, so that it is 50% closer to the mean value of the adjacent fields. Regarding the example given below, adjacent fields of field 1 are fields 2, 4, and 5. With respect to these fields, a new mean value must be calculated. Thereon, the difference between original and mean value is required, which must be divided by 2 (50%) and added to the original value, to obtain the new value.

Example:

1	2	3
4	5	6
7	8	9

The new values are computed as follows:

Feld 1:	1 + (((2+4+5)/3-1)/2)	=2
Feld 2:	2 + (((1+3+4+5+6)/5-2)/2)	=2
Feld 3:	3 + (((2+5+6)/3-3)/2)	=3
Feld 4:	4 + (((1+2+5+7+8)/5-4)/2)	=4
Feld 5:	5 + (((1+2+3+4+6+7+8+9)/8-5)/2)	=5
Feld 6:	6 + (((2+3+5+8+9)/5-6)/2)	=6
Feld 7:	7 + (((4+5+8)/3-7)/2)	=6
Feld 8:	8 + (((4+5+6+7+9)/5-8)/2)	=7
Feld 9:	9 + (((5+6+8)/3-9)/2)	=8

General Information: Further information can be found under https://ls12-www.cs.tu-dortmund.de/daes/lehre/lehrveranstaltungen/sommersemester-2019/rechnerarchitektur-ss19.html. Submitting solutions to the exercise sheets is not required.