Assignment MPI: Circuit Satisability
Parallel and Grid Computing Lecture

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Exercise 1. Sequential Program
Please find the solution in the **circuit.c** file

Exercise 2. Parallel Program Design

1. Since we have 16 bits on the input, there are 2^{16} possible inputs. This is the number of tasks as the exercise describes, in the code it's being implemented in a loop where we iterate exactly 2^{16} times, thus having 2^{16} tasks.

2. Yes tasks are independent due to the reason is that each of the unique 2^{16} inputs is assigned to a task, which does its own independent computation according to the circuit and checks independently of others whether it is 1. The graph regarding tasks is depicted on Figure 1.

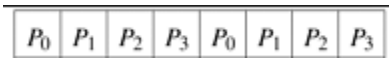

Figure 1: Cyclic work distribution.

The problem was solved cyclic work distribution. The type of problem is called domain decomposition and depicted on Figure 2.

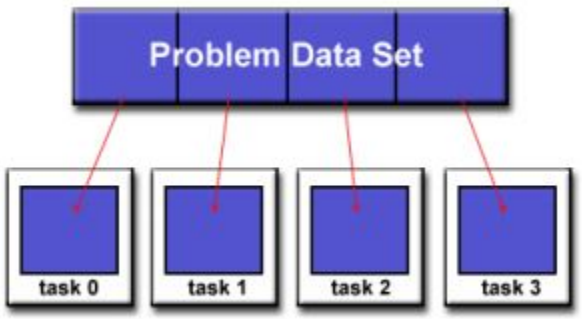

Figure 2: Domain decomposition.

3. (a) Communication pattern is structured since we all the tasks are computing the same equation specified to the formula
   (b) The computation time computation time is roughly the constant.
   (c) The mapping strategy is that we divide the input data into chunks of n/p elements of data each could be calculate by one of the p process. In practice we could use the round robin approach. For example p_0 gets element $0, 0+p...n$, p_1 gets $1, 1+p...n$ and so on.

Exercise 3. Parallel Program Design

1. The MPI version of a sequential is in **mpi_circuit_1.c** fg
2. Total number of solutions **mpi_circuit_2.c**
3. The program is **mpi_circuit_3.c**.The benchmarked parameters can be found in **data.txt** the plotted results (**plot.jpg**) are shown on Figure 3

Cores	Max	Min	Avg
12	0.000373	0.000242	0.000314
11	0.000413	0.000385	0.000404
10	0.000461	0.000372	0.000412
9	0.000582	0.000451	0.000496
8	0.000521	0.000365	0.000455
7	0.001546	0.000588	0.000762
6	0.000724	0.000624	0.000677
5	0.000915	0.000856	0.000891
4	0.001006	0.000735	0.000920
3	0.001510	0.001432	0.001479
2	0.002087	0.001884	0.001986
1	0.004060	0.004060	0.004060

References

[1] Sbastien Varrette. *The Lecture slides*.

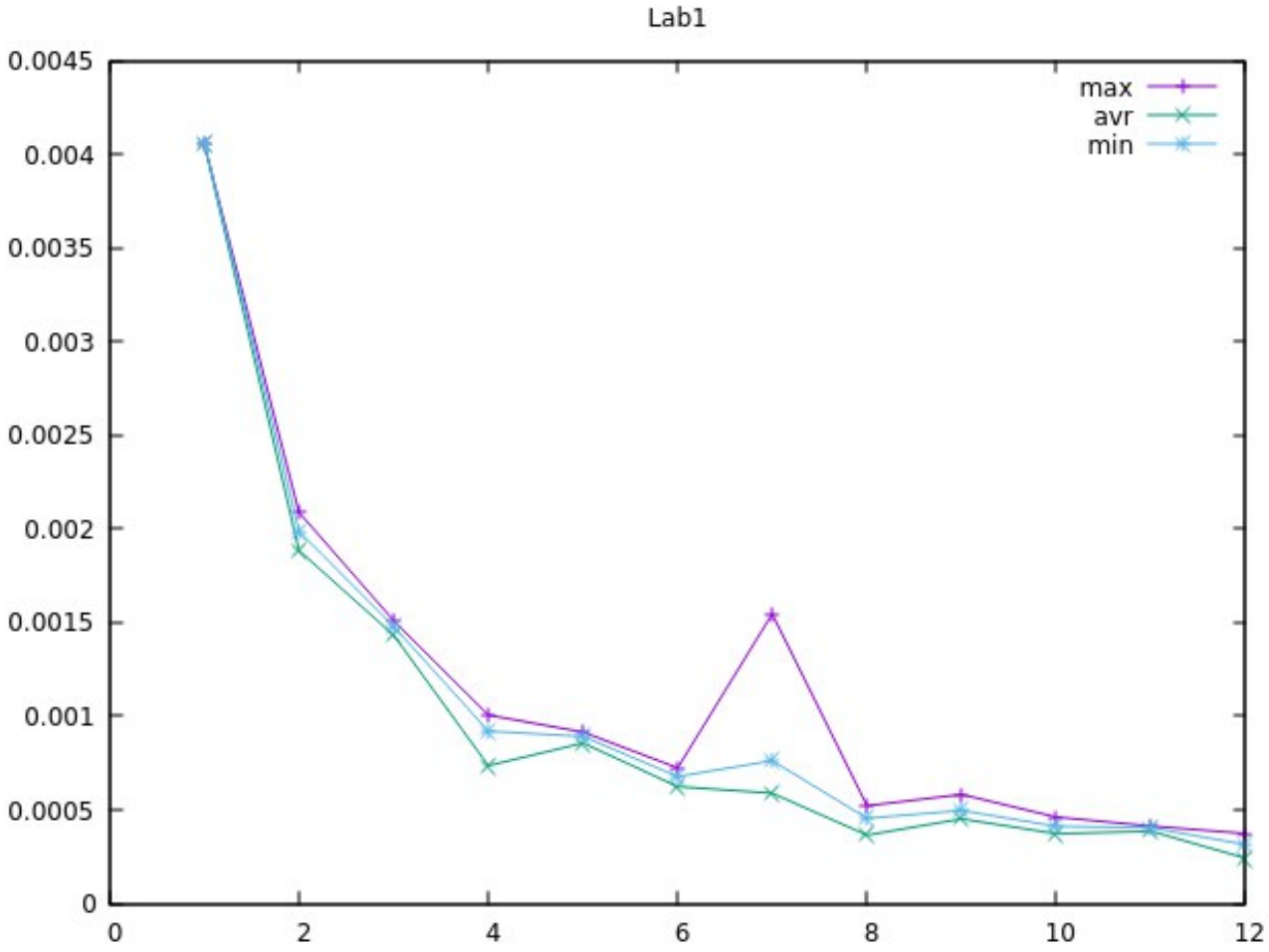

Figure 3: Number of cores to execution time dependency.