# SODS LLS CONTEST 2020-2021

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**Description of the algorithm:**
The core idea of the algorithm consists in a comparison between a series of information collected from different mappings of the same design, and a cost function.
Specifically, both for area and threshold voltage optimization, we started from a design that is completely mapped in a certain way. From this design, we extracted information about the area, the leakage power, and the dynamic power. Afterwards, the same design has been mapped in a different way, and the same information have been extracted.
Finally, these two groups of information have been compared together with a cost function, to determine which changes were worth to be taken.
Notice that the flow of the script firstly analyzes the area, and then the threshold voltage. The optimize function, invoked at the end, gathers the results of the previous analysis.

**Area Analysis**:
Starting from the design produced by *pt_analysis.tcl*, information is extracted. The design is then mapped to achieve minimum area occupation; information is extracted again.
Statistics are compared with a cost function that considers which ratios, among the ones contributing to final score, are dependent from an area improvement. As all ratios improve, their sum is compared to the increase of the delay as:

$$\frac{\left(\frac{area\_init}{area\_min} + \frac{leakage\_init}{leakage\_\_min} + \frac{dynamic\_init}{dynamic\_min}\right)}{\left(\frac{delay\_min}{delay\_init}\right)}$$

Notice that the results of the comparison are saved in a list ordered in a decreasing way. In this way, the first elements of the list are the ones that are much worth to be changed.

**Threshold Voltage Analysis**:
Starting again from the original circuit (*pt_analysis.tcl*), everything is mapped onto high voltage threshold. Information is extracted. The design is then mapped onto low voltage threshold and the same information is extracted. Statistics are compared with a cost function relating leakage power variations to delay variations: as leakage power consumption improves, delay increases.

**Optimize**:
Based on the results of area and threshold voltage analysis, the optimize function modifies the design until the slack constraint is met. If the slack gets never violated, optimize goes on, as long as it is possible to make efficient optimizations.
At first, area is optimized. Once the slack is violated, or area optimization is no longer possible, optimize switches to threshold voltage optimization: as the design is still mapped onto low voltage threshold, the function considers switching some cells to high voltage threshold.