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# **SAT and CP-based approach to VLSI problem**

## **Project report for Combinatorial Decision Making and Optimization Module 1**

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### **Abstract**

Very Large Scale Integration (VLSI) refers to the trend of integrating circuits into silicon chips. A typical example is the smartphone. The modern trend of shrinking transistor sizes, allowing engineers to fit more and more transistors into the same area of silicon, has pushed the integration of more and more functions of cellphone circuitry into a single silicon die (i.e. plate). This enabled the modern cellphone to mature into a powerful tool that shrank from the size of a large brick-sized unit to a device small enough to comfortably carry in a pocket or purse, with a video camera, touchscreen, and other advanced features. The project aim is to face the problem with different approaches such as SAT, SMT and CP to evaluate their strenghts.

# Introduction

## Description of the problem

The problem require the design of the circuits defining your electrical device in a way to pack more transitors as possible into the same area of silicon. Formally, given a fixed-width plate and a list of rectangular circuits, decide how to place them on the plate so that the length of the final device is minimized (improving its portability). In order for the device to work properly, each circuit must be placed in a fixed orientation with respect to the others, therefore it cannot be rotated. Finally some hipothesis of implementation are advanced for a special case of the problem where rotations are allowed.

The problem is known in literature as 2 Dimension Strip Packing (2DSP) and is known to be NP-Hard. Moreover when rotations and translation are allowed, it is strongly NP-hard and it is even not known whether it is in NP, because it is complicated to encode rotations efficiently [1]

Following the specifications of the project the problem has been faced with different approaches, namely: CP, SAT and SMT.

To come up with the best model/encoding and tackle relatively more difficult instances of the problem, in the most efficient way, further analysis under different restriction has been taken in consideration. Also as mentioned by the specification of the assignment no assumptions based on the instances has been used.

Finally, for each approach, the results have been collected and presented in the relative section, to show with experimental data which is the best combination of techniques.

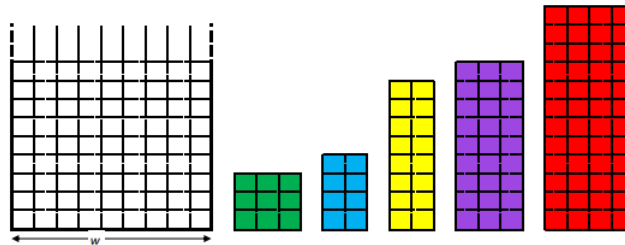


Figure 1: Graphical representation of the instance.

## References

- [1] <http://courses.csail.mit.edu/6.890/fall14/scribe/lec2.pdf>