CSE248 Fall 2023 Exercise 1: Floorplanning Topologies

Due Time : 11:50pm, Wednesday 10/11, 2023 Submit to Gradescope
Gradescope: `https://gradescope.com/`

A. Read IEEE IRDS International Roadmap Executive Summary, and write a summary (<30 words) of the potential progress of Moore's Law in the next five years.

B. Read slide Chapter 1 from the book of LT Wang to get an overview of the VLSI design process. Try to write your prediction (<30 words) on what process can facilitate the progress of Moore's law in the next five years.

C. In this exercise, we investigate floorplanning topologies using the On-Line Encyclopedia of Integer Sequences (OEIS) for 2D and 3D layouts. For 2D layout, we are given a 2D rectangular box. We divide the box into n rectangles with no dead-space. For 3D layout, the box is a three-dimensional rectangular cube. The dimensions of the rectangles (cubes) are flexible but strictly positive. Each division configuration is mapped to a topology. Two topologies are viewed as identical if we can adjust the lengths of the rectangles (cubes) and the bounding box to make the configuration (plot) the same.

1. Enumerate the number of topologies for 2D floorplanning as a function $f_2(n)$ of rectangles n.

2. Validate that the sequence $f_2(n)$ is equal to the sequence number of twin binary trees.

3. Assume that the floorplan is symmetric by rotation. Repeat item 1. Check the OEIS result.

4. Assume that the floorplan is symmetric by flipping. Repeat item 1. Check the OEIS result.

5. Assume that the floorplan is symmetric by rotation and/or flipping. Repeat item 1. Check the OEIS results.

6. Enumerate the number of topologies for 3D floorplanning as a function $f_3(n)$ of rectangles n. Check the OEIS result.

7. Assume that the floorplan is symmetric by rotation. Repeat item 6. Check the OEIS result.

8. Assume that the floorplan is symmetric by flipping. Repeat item 6. Check the OEIS result.

9. Assume that the floorplan is symmetric by rotation and/or flipping. Repeat item 6. Check the OEIS results.