ECE 5460/6460: VLSI Design Automation

Homework 3

Due: 10/11/2016

1. Refer to Figure 3.43 on page 153 of the textbook. The sizes of individual modules are listed in Table 3.6 on page 154.
    a. Draw the skewed slicing tree corresponding to this slicing floor plan. [5 points]
    b. Give the corresponding normalized polish expression. [5 points]
2. Given a Polish expression E = 12H34V56VHV
    a. Does E satisfy the balloting property (in page 109 Definition (2))? Justify your answer. [4 points]
    b. Is E a normalized Polish expression? Justify your answer. [5 points]
    c. Give the slicing tree corresponding to the Polish expression E. [6 points]
    d. If the modules have the heights and widths as listed in the table below. If all modules are rigid and have free-orientations. What will be size of the smallest bounding rectangle corresponding to the normalized Polish expression E? Show all the steps with explanations that led to your answer. [10 points]

Module#	Width	Height
1	2	3
2	2	2
3	3	1
4	2	3
5	1	2
6	2	2

    e. Plot the corresponding slicing floorplan. [5 points]

3. **Programming assignment:** Here you are required to program **a part** of the simulated annealing algorithm for slicing floorplan. The algorithm is described in detail in the textbook (page 121), and is also discussed in class. This routine will be used in future assignments to develop the entire algorithm.
    a. (60 points) Implement the slicing tree sizing algorithm, which takes a **floorplan topology** and a **list of possible shapes for each module** and computes the optimal area for the floorplan using the algorithm discussed in class and also in Example 3.4 in the textbook. In order for this procedure to be used in the simulated

annealing, use **normalized polish expression** to describe the topology in the input. Name your routine as **cost()** that takes a NPE as its input.

Input Formats: The input file consists of:

1. Names, areas and aspect ratios of the modules. They are of the form:

```
1    13.60    0.52
2    3.69     0.30
3    16.71    0.50
4    1.87     0.35
5    5.29     1.15
```

The i-th row provides information of module i, for all i = 1, 2… n.
It consists of (N_i, A_i, R_i) where N_i is the module name, A_i is the area of module i and R_i is the aspect ratio of module i. For example, module 2 has area 3.69 and an aspect ratio of 0.3.

Instructions on submission:

1. PLEASE USE INPUT FILE "input_file.txt" AS AN INPUT FOR YOUR PROGRAM
2. Output: Please output the topology (NPE) and the cost of the floorplan (area).
3. For the given input file, in your main() program, invoke the cost() routine with the following topologies within your code, printing the topology and area each time.
    a. 12V3V4V……kVlV
    b. 12H3H4H…….kHlH
    c. 213546H7VHVa8V9HcVHgHibdHkVHfeHVlHVjHVH
4. **Please submit soft copy of your code and the the .exe file (zipped into a single file) through canvas.**

This assignment will be graded on the following criteria

a) Correct execution [25 points] - we will test your area for 3a, 3b, 3c.
b) Code commenting [5 points] - will be awarded for properly commenting the code.
c) Working code [30 points] – These points will be awarded for a completed program that works and outputs the area and topology.