Northwestern University
Electrical Engineering and Computer Science
EECS357: Introduction to VLSI CAD
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Jan 14, 2014
Handout #2
Due: Jan 21

Homework 1

You may discuss the assignments with your classmates but need to write down your solutions independently. Be careful with your handwriting. Unclear solutions will be assumed to be wrong.

1. (20 points) Please describe the general flow of modern VLSI design, and the general flow of physical design (also known as layout).

2. (20 points) Given $X > 0$ and $Y > 0$, what does the following algorithm print? Prove your answer.

```
x := X; y := Y; u := X; v := Y;
while (x ≠ y)
    if (x > y) {
        x := x − y; u := u + v;
    } else {
        y := y − x; v := v + u;
    }
print ((x + y)/2); print ((u + v)/2);
```

3. (20 points) The Fibonacci numbers are defined recursively by $F(0) = 0, F(1) = 1$, and $F(n+2) = F(n)+F(n+1)$ for $n \geq 0$. Prove that $F(n) = (\Phi^n - \hat{\Phi}^n)/\sqrt{5}$ where $\Phi = (1+\sqrt{5})/2$ and $\Phi = (1-\sqrt{5})/2$.

4. (20 points) Arrange the following functions in increasing order of complexity, and give reasons for your arrangement:

$$n^2 \log n, n \log^2 n, n, 2^n, n\sqrt{n}, n^{0.5n}, n^2, n^{99}, n^{\log n}$$

5. (20 points) Write the following function in the big-O notation (as simple as possible):

   (a) $4n^2 + 2.5n \log n + 9n + 81$

   (b) $0.1n^2 + 10^6 n\sqrt{n}$

   (c) $n \log_e n + 99n \log_2 n$

   (d) $2^n + e^n$