

Math 170A Lecture Notes (Professor: Lei Huang)

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January 13, 2024

Week 1 Notes (1/8 - 1/12/2024)

For this class, we shall define the number of flops an algorithm takes as the number of individual $+$, $-$, \times , $/$, and $\sqrt{}$ operations on real numbers used in the algorithm.

For example: taking the inner product of two vectors $\vec{u} = (u_1, u_2, \dots, u_n)$ and $\vec{v} = (v_1, v_2, \dots, v_n)$ requires n multiplications and $(n - 1)$ additions. So we'll say it has a flops count of $2n - 1$

Technically, the word "flop" stands for floating (point) operation. Based on that knowledge, hopefully it is easier to guess what is and is not a flop. For instance, observe the code written below for taking an inner product of two n -vectors.

```
1  P = 0
2  for i = 1:n
3      P = P + v(i) * w(i)
4  end
```

Neither incrementing i nor initializing any other variables are counted towards the flop number. Because the code does n additions and multiplications between floating point numbers, we say this function has $2n$ flops.

For a sequence a_n , we define $a_n = O(b_n)$ if there exists real constants $C, N \geq 0$ such that for $n \geq N$, $a_n \leq Cb_n$.