Desirable runtime and space complexities

- Want program to finish while we are alive

- Find the 100th Fibonacci number (assume each operation is 1 microsecond):

  - Naive recursive program is $O(2^n)$, so will run in time proportional to 2^{100}, so around 10^{16} years (Earth has only existed for around 4.5×10^9 years)

  - Iterative program is $O(n)$, so will run in time proportional to 100, so around 100 microseconds

- Typically want $O(n)$; if possible, want even lower, like $O(\log(n))$.

- At worst, $O(n^2)$ may be acceptable. Exponential time or worse is typically bad.

2. Graph theory