3/2/2020 Engineering 7 Midterm 1 Review

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Recursion vs Iteration

- Recursion

- Iteration

- F(m) = F(F(F(F(...F(n))))), where n is the base case
  - Function calls must always eventually reach a base case; otherwise, infinite recursion → “out of memory”
- Stack depth: binary tree
  - **Example**: myFArray(5)
    - **myFArray.m**
  - What is the stack depth for cheeseBoard?

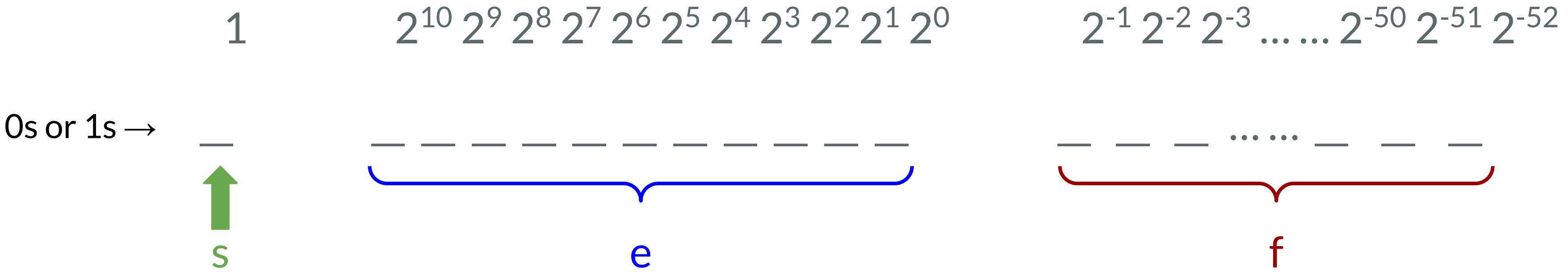
- Execute the same task repeatedly
  - While loops → boolean statements
  - For loops → set number of iterations

Memory and Data Types

- int8, uint8, int16, uint16, int32, int64, single (32 bit), double (64 bit)
    - How much memory is used to store each of these?
        - Use built-in MATLAB function `whos`
    - What are the ranges of numbers that can be stored as each of these data types?
        - **Example**: int8
        - What is the range of values that can be represented with an uint8?
- String arrays and char arrays
    - How are each of these data types concatenated? (Review Lab 2)
    - What is the difference between string arrays and char arrays?
- Cell arrays
    - How is indexing and accessing elements different from a double?
        - How is an element of a cell array different from an element of a double?
    - Review Lab 2 and Cell Arrays worksheet

Floating Point Numbers

- For a 64 bit number (double precision): **1 bit** for sign (s); **11 bits** for exponent (e); **52 bits** for fraction (f)
  - **Take note of the cases that don’t follow the decimal formula!** See Lab 5
  - How are the bits assigned for a 32 bit number (single precision)?



1

$2^{10}\ 2^{9}\ 2^{8}\ 2^{7}\ 2^{6}\ 2^{5}\ 2^{4}\ 2^{3}\ 2^{2}\ 2^{1}\ 2^{0}$

$2^{-1}\ 2^{-2}\ 2^{-3}$ …… $2^{-50}\ 2^{-51}\ 2^{-52}$

0s or 1s →

s

e

f

For a double: $n = (-1)^{s} \cdot 2^{(e-1023)} \cdot (1+f)$

Global vs Local Variables

- Scope - what can a function “see” as it’s running?
  - Global variables are **accessible only in the spaces they are introduced to** because they remain in the computer’s memory, unlike local variables
  - But they **maintain the same value AND any modifications made to it** in any of the spaces in which it is referenced
  - Global variable ≠ persistent variable
- MATLAB demo
  - Example: global variables in functions
    - f.m

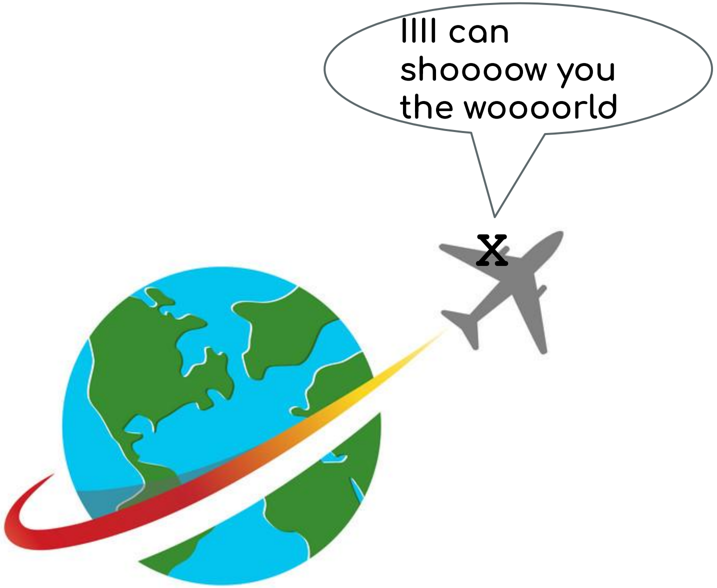
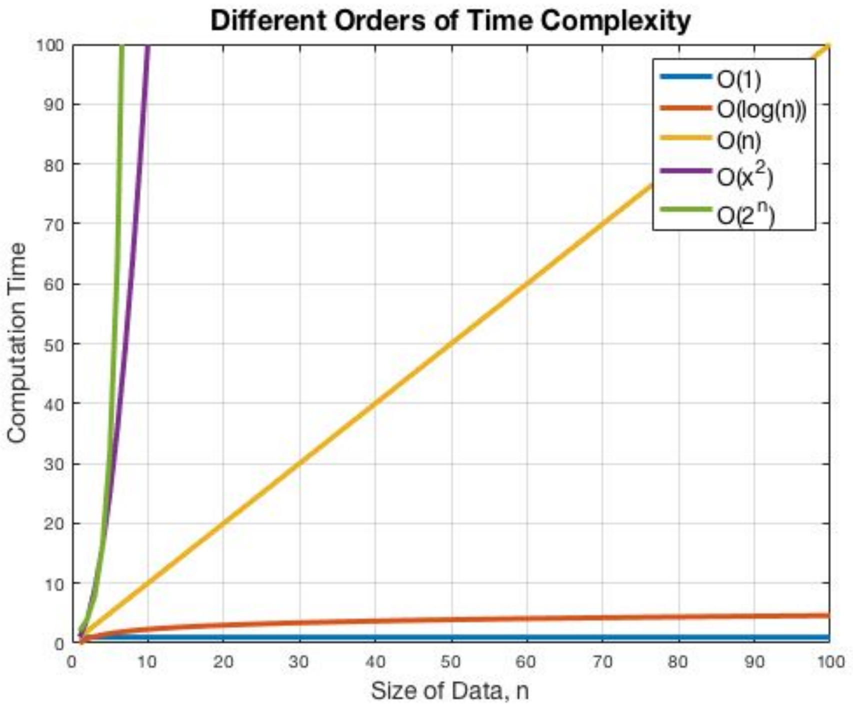


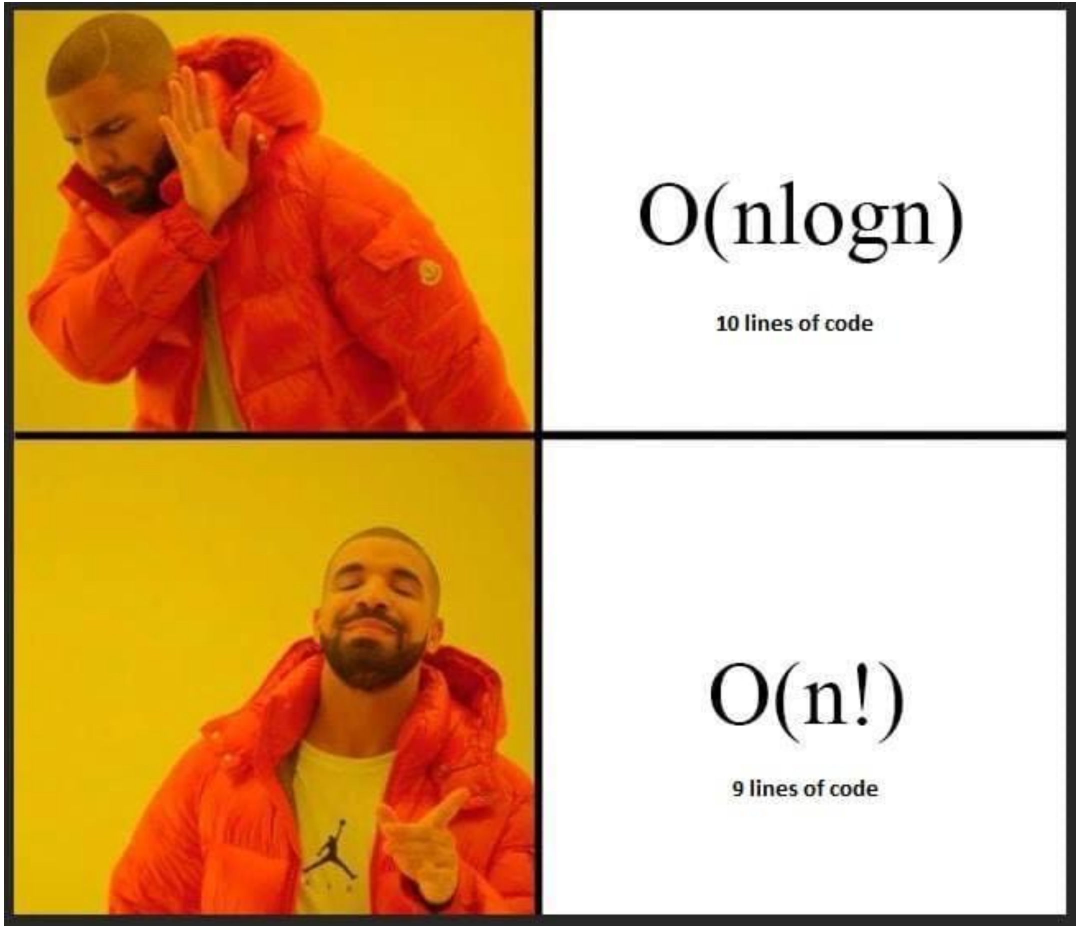
Figure 1: A variable `x` gone global

Big O Notation

- Overview of time complexity
  - Notation and WCCT
- How do I look at code and determine what its time complexity is?
  - **Example**: searching algorithms
    - MATLAB demos: who has my bag?
      - O(n), O(log(n)), O(1)
      - **bagSearch.m**
      - **binaryBagSearch.m**
        - **scores_lab04.mat**
- Think about the time complexities of:
  - searchGrade (Lab 5)
  - myFArray (see Week 6 Discussion Slides)



Source: https://dev.to/jainroe/the-ultimate-guide-to-big-o-notation--learning-through-examples-5ecp



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Exam Taking Tips

- 25 questions, 50 minutes, multiple choice
- There are easy, medium, and hard questions, BUT they are each worth the same amount of points
    - If you can't figure out immediately how to start a question, skip it and come back
- There are a mix of questions with and without code in them
    - READ CAREFULLY when determining what is worth typing into MATLAB
    - Watch your time when you are typing code into MATLAB
        - All questions are possible to answer without typing into MATLAB
- It is an open note exam (notes must be bound, no loose leaf), but be careful with your time when going through your notes
- Use only `help` for MATLAB documentation; DO NOT USE `doc`