Math 3607 Topic 1 Review

Concepts and MATLAB Functions

MATLAB The Calculator

- arithmetic operations
- scientific notation
- elementary functions
  - trig: `sin`, `cos`, `tan`, `sind`, `cosd`, `tand`, ...
  - inv trig: `asin`, `acos`, `atan`, `atan2`, ...
  - exp and log: `exp`, `log` (natural), `log2`, `log10`, ...
  - factorial: `factorial`
  - roots: `sqrt`, `nthroot`
  - misc: `mod`, `rem`, `ceil`, `floor`, `primes`

Useful Commands

- `format`
  - `short`, `short e`, `short g`
  - `long`, `long e`, `long g`
  - `loose`, `compact`
- `clear`
- `clc`

Interactive Features

- `input`
- `disp`
- `fprintf`

Conditional Statements (if-statements)

- Allow a code to run under contingency.
- Conditions are logical expressions; see below.

Relational and Logical Operations

- Relational operators:
  - `<`, `<=`, `>`, `>=`, `==`, `~=`
  - test the nature of relation between two variables
  - results are either `true` or `false` (logical variables)
- Logical operators:
  - operate on logical variables
  - and (`&&`), or (`||`), not (`~`), exclusive or (`xor`)
- Essential ingredient in forming conditional statements

Iterations

- for-loop
- while-loop
- panic buttons: `break`, `continue`

Arrays

- construction
  - `zeros`, `ones`, `eye`, `diag`
  - `rand`, `randi`, `randn`
  - colon operator (`:`)
  - `linspace` and `logspace`
- operations
  - *linear algebra*: inner/outer products
  - elementwise (`.*`, `./`, `.^`)
- building array out of arrays
  - concatenation
  - `reshape` and `repmat`
- slicing
  - extract/replace part or all of a row/column
- array(data) Manipulation
  - `max`, `min`
  - `sum`, `prod`
  - `cumsum`, `cumprod`
  - `diff`
  - `sort`
  - `mean`, `std`, `var`
- `find` function

Timing

- `cputime`
- `tic` and `toc`

Graphics

- customizing appearance to plots
  - color
  - marker
  - line style
- modifying figure window
  - `close`, `clf`, `shg`
  - `axis equal`, `axis tight`, `axis image`
  - `xlabel`, `ylabel`, `title`
  - `legend`
  - `hold on`, `hold off`
- multiple plots
  - stacking
  - subplot
- 3-D graphics: `plot3` and `surf`
- `meshgrid`

User-Defined Functions

- anonymous functions
- function m-files
  - local variable
  - pass by value

Key Examples and Problems

Leap year

- Lecture 3
- HW02, Problem 1

Coordinate Conversion

- Lecture 3
- HW02, Problem 2

Approximation and Sequences

- Approximation of π by tiling (Lecture 4)
- Sequences converging to π (HW02, Problem 5)
- Up/Down Sequence (Lecture 5)

Randomness and Simulations

- Game of 3-Stick (Lecture 4; HW02, Problem 4)
- Gap of 10 (Lecture 5; HW03, Problem 2)
- Birthday problem (Lecture 7; HW03, Problem 6)

Graphics

How is each of the following function types plotted in MATLAB?

- $y = f(x)$
- $r = f(\theta)$
- $\mathbf{r}(t) = \langle x(t), y(t) \rangle$
- $\mathbf{r}(t) = \langle x(t), y(t), z(t) \rangle$
- $z = f(x, y)$

Spiral Triangle

- Lecture 09

"Elegant" Construction/Manipulation of Arrays

- Problem 3, 4, 5 of HW03