MATH 3341 — Fall 2019

Lab 03: Functions, Control Flows, and LaTeX

Download `Math.3341.Lab.03.zip`, unzip it by following the Windows Instructions on WyoCourses. Change the current working directory of MATLAB to the unzipped folder, and type `edit lab_03_script` in the Command Window.

1 Anonymous Function

(a) Define an anonymous function `f`, where $f(x) = \sin x - \frac{x^3}{9}$.

(b) Define a composite function `g`, where $g(y) = e^{\cos(f(y))+y^4}$.

(c) Use `linspace` to define a *column vector* `t`, of which the range is from -1 to 1 with 10 entries.

(d) Evaluate function `g` at `t`, and assign the result to `h`.

2 Creating Function Files

Algorithm 1: Factorial using recursion

Function factorial_recursive(n)**:**
  Input: Integer n
  Output: $n!$
1 **if** $n = 0$ **then**
2 $f \leftarrow 1$;
3 **else**
4 $f \leftarrow n \times$ factorial_recursive$(n-1)$;
5 **end**
6 **return** f;
end

Algorithm 2: Factorial using for-loop

Function factorial_for(n)**:**
  Input: Integer n
  Output: $n!$
1 $f \leftarrow 1$;
2 **for** $i \leftarrow 1$ **to** n **do**
3 $f \leftarrow f \times i$;
4 **end**
5 **return** f;
end

(a) Create a function file `factorial_recursive.m` to implement the pseudocode in Algorithm 1.

(b) Create a function file `factorial_for.m` to implement the pseudocode in Algorithm 2.

(c) In the script file `lab_03_script.m`, use a for-loop to calculate $n!$ where $n = 1, \ldots, 20$ by calling the above two function files as follows

```
fprintf('%2s %20s %20s\n', 'n', 'factorial_recursive', 'factorial_for');
for n = 1:20
    f1 = factorial_recursive(n);
    f2 = factorial_for(n);
    fprintf('%2d %20d %20d\n', n, f1, f2);
end
```

In the Command Window enter the command `diary('lab_03_output.txt')`, run the script file `lab_03_script.m`, then type `diary off` to store the output to `lab_03_output.txt`. Then upload the script file `lab_03_script.m`, output file `lab_03_output.txt`, and function files `factorial_for.m` and `factorial_recursive.m` to the folder `src` on Overleaf.

3 Basics of LaTeX

Go to Overleaf, open `body.tex` under the folder `LaTeX`. In the last section of the report, you will reproduce the text in the box below using LaTeX:

Consider the function

$$f(x) = \frac{x^2 - 1}{x + 1}.$$

To simplify this funciton we can factor the numerator and cancel like terms

$$\begin{aligned} f(x) &= \frac{x^2 - 1}{x + 1} \\ &= \frac{(x - 1)(x + 1)}{x + 1} \\ &= x - 1. \end{aligned}$$

A general 3×3 matrix A has the form

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}.$$

Once you finish, recompile, and submit the generated `.pdf` file to WyoCourses.