MATLAB assignment 5

Introduction to Linear Algebra (Week 5) **Fall, 2019**

1. *Symbolic Computation in* MATLAB (continued)

   (a) In this problem, we are doing several calculus problems by symbolic computation.

      i. Using the MATLAB commands `diff`, find f_{xx} which is the second derivative of the function f where

      $$f(x, y) = \sin(x^2 y) + \cos(xy^2).$$

      ii. From the result of (i), using the MATLAB command `subs`, find $f_{xx}(1, 2)$. In order to change a symbolic answer to a numeric one, use the MATLAB command `double` which stands for double precision.

      iii. Using the MATLAB command `limit`, find the following limit

      $$\lim_{h \to 0} \frac{\cos(x + h) - \cos(x)}{h}.$$

   (b) In this problem, we plot the Taylor series expansion of the following function:

   $$f(x) = \frac{1}{5 + \cos x}.$$

      i. Use the MATLAB command `taylor` to find the Taylor series expansion for $f(x)$ centered at $x = 2$ up to the 10th order terms.
      [Remember that a constant term is 0th order term.]

      ii. Use the MATLAB commands `fplot` and `plot`(and also `hold on`) to plot the resulting polynomial of (i) for $1 \leq x \leq 3$ together with the given function $f(x)$ in the same figure.

(c) In this problem, we plot the graph and find local maxima, minima, and inflection points of the following function:

$$f(x) = \frac{3x^2 + 6x - 1}{x^2 + x - 3}.$$

i. Using the MATLAB command `ezplot`, plot the graph of f.
[Actually, there is an command `fplot` which is a upgraded version of `plot`. But let's use the `ezplot` to follow the intent of this problem.]

ii. Using the MATLAB commands `limit` and `plot`, on the figure from (i), draw the horizontal and vertical asymptotes of f.

iii. Using the MATLAB commands `diff` and `solve`, find local maxima, minima and inflection points of f.
[Can you expect what the 'integration command' is?.]

iv. Using the MATLAB commands `plot`, on the figure from (ii), indicate all critical and inflection points of f.

2. Let there are two functions f and g given by

$$f(x, y) = \mathrm{e}^{\sin(xy^2)} + \mathrm{e}^{-\cos(x^2y)},$$
$$g(z) = \arctan(z).$$

Referring to the problem 1 compute values of $f_{xy}(2, -3)$ and $\int_{-1}^{1} \left|g(z) - T_g^9(z)\right|^2 \mathrm{d}z$ where the $T_g^9(z)$ denotes 9th order taylor expansion for $g(z)$.

Submission guide

- Download the guide code(*assignment5_guide.zip*) in the KLMS and fill out missing parts to find the value of $f_{xy}(2, -3)$ and $\int_{-1}^{1} \left|g(z) - T_g^9(z)\right|^2 \mathrm{d}z$. Use **only symbolic computations** to get the values.
- Upload the completed code files, `assignment5_2.m`, to 'Homework box for MATLAB assignment 5' in the KLMS

Due date : Oct 18 (Fri) 10:55 a.m.
Late submission will not be allowed.

3. Read two attachments "MATLAB_Week5.pdf" and practice by yourself.