[PRINT]

MATH2089 - Numerical Methods and Statistics T2- 2019,
Aref Taleb, 8/5/19 at 2:10:24 PM AEST

Question 1: Score 0/4

You are to approximate the integral

$$I(f) \equiv \int_a^b f(x)\,dx = \int_3^5 |\sin(x)|\, e^{-x/2}\,dx.$$

a) Create a vector `xplt` of 601 equally spaced points on the interval. Give the MATLAB command(s) you used.

Your response	Correct response
No answer	**xplt = linspace(3,5,601)**

Grade: 0/1.0

b) What MATLAB code would you use to create an anonymous function `myf` to define your function f in a)? Your function must accept a vector of inputs, producing a vector of the same size as output.

Your response	Correct response
myf = @(x) sin(abs(x)).*exp(-1/2.*x)	**myf = @(x) abs(sin(x)).*exp(-1/2.*x)**

Grade: 0/1.0

c) Plot the integrand over the interval $[3, 5]$, including a grid. Does the plot indicate any features of the integrand that will make it difficult for a quadrature (numerical integration) rule? Where is this point? (Give your answer to at least 3 significant figures, you can work this out algebraically or numerically).

$x =$

Your response	Correct response
[4,1]	**3.141593±0.1**

Grade: 0/1.0

d) Using `quad` or `trapz` (make sure you know how a function works before you try to use it), calculate the integral $I(f)$.(Correct to 3 significant figures).

$I(f) =$

Your response	Correct response
34.6	**0.156 [3 significant digits required]**

Grade: 0/1.0

Total grade: 0.0×1/4 + 0.0×1/4 + 0.0×1/4 + 0.0×1/4 = 0% + 0% + 0% + 0%
Feedback:

Question 2: Score 0/4

We are going to calculate the **LARGEST** value x^* which is a point of intersection for the functions $f_1(x) = \sin(\ x)e^{-x/3}$ and $f_2(x) = 1/15\ x^2$.

a) Write the problem of finding x^* as the solution of a nonlinear equation $f(x) = 0$.

$f(x) =$

Your response	Correct response
No answer	**sin(pi*x)*exp(-1/3*x)-1/15*x^2**

Grade: 0/1.0

b) Either create an anonymous function myf or a MATLAB function M-file myf.m to define your function in (a). Your function must accept a vector of inputs, producing a vector of the same size as output.

c) Create a vector z of 501 equally spaced points on $[0, 5]$.

Your response	Correct response
No answer	**z = linspace(0,5,501)**

Grade: 0/1.0

d) Plot your function f over $[0, 5]$ including a grid. From the plot, give a starting point x_0 (with at most 2 significant figures) for an interative method to find the largest value of x^*.

$x_0 =$

Your response	Correct response
4	**2.5±0.5**

Grade: 0/1.0

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e) Use the MATLAB function fzero starting from x_0 to find x^*.

f) Give the value of x^* to 6 significant figures.

$x^* =$

Your response	Correct response
3	**2.53267 [6 significant digits required]**

Grade: 0/1.0

g) Check the value of $f(x^*)$.

Total grade: 0.0×1/4 + 0.0×1/4 + 0.0×1/4 + 0.0×1/4 = 0% + 0% + 0% + 0%
Feedback:

Question 3: Score 0/4

The number of flops required by a problem of size n is $n^3 \log_e(n)$.

You are to find the problem size n^* that gives a total number of flops equal to $181,195$.

a) Define a MATLAB variable G whose value is $181,195$.

b) Write the problem of finding n^* as the solution of a nonlinear equation $f(n) = 0$.

$f(n) =$

Your response	Correct response
No answer	**n^3*ln(n)-181195**

Grade: 0/1.0

c) What MATLAB code would you use to create an anonymous function `func` to define your function f in b)? Your function must accept a vector of inputs, producing a vector of the same size as output

Your response	Correct response
func = @(n) (n^3)*log(n) - 181195	**func = @(n) (n.^3).*log(n) - 181195**

Grade: 0/1.0

d) Create a vector z of 401 equally spaced points on [0,100] (Enter your answer as you would into MATLAB).

Your response	Correct response
No answer	**z = linspace(0,100,401)**

Grade: 0/1.0

e) Plot your function f over $[0, 100]$, including a grid. From the plot, give a starting point n_1 (with at most 2 significant figures) for an interative method to find n^*.

$n_1 =$

Your response	Correct response
	35±6

Grade: 0/1.0

f) i) Use the MATLAB function fzero to find n^* starting from n_1.

ii) Give the value of n^* rounded to the nearest integer.

$n^* =$

Your response	Correct response
567	**37 [2 significant digits required]**

Grade: 0/1.0

.

iii) Give the value of f at the integer value from (ii) to 2 significant figures.

$f(n^*) =$

Your response	Correct response
34	**50653*ln(37)-181195 [2 significant digits required]**

Grade: 0/1.0

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Total grade: 0.0×1/6 + 0.0×1/6 + 0.0×1/6 + 0.0×1/6 + 0.0×1/6 + 0.0×1/6 = 0% + 0% + 0% + 0% + 0% + 0%

Feedback:

Question 4: Score 0/4

Enter exactly the MATLAB commands:

clear all

A = gallery('toeppen',300);

a) What are the values of the first 3 elements in the second row of A? (Enter your answer as a Matlab vector in the correct order).

Your response	Correct response
No answer	**[-10.0, 0., 10.0]**

Grade: 0/1.0

b) Is A symmetric?

Your response	Correct response
Yes	**No**

Grade: 0/1.0

Create a spy plot of the non-zero elements of the matrix A.

c) What is the upper and lower bandwidth of A?

Lower =

Your response	Correct response
	2

Grade: 0/1.0

Upper =

Your response	Correct response
	2

Grade: 0/1.0

d) What is the sparsity of A as a percentage?

Your response	Correct response
	100*1194/(300^2)±0.05

Grade: 0/1.0

%

e) Give an estimate of the 1-norm condition number of A. $\kappa_1(A) =$

Your response	Correct response
	23.0495±0.1

Grade: 0/1.0

A is known exactly and the relative error in $\mathbf{b}$ is 4.6×10^{-2}

f) Define the variable reb to have value 4.6×10^{-2}. Give any Matlab command(s) you used.

Your response	Correct response
No answer	**reb = .4600000000e-1**

Grade: 0/1.0

g) Estimate the relative error in a computed solution $\bar{\mathbf{x}}$ to $A\mathbf{x} = \mathbf{b}$.(Answer to at least 3 significant figures).

Your response	Correct response
	1.06 [3 significant digits required]

Grade: 0/1.0

Total grade: 0.0×1/8 + 0.0×1/8 + 0.0×1/8 + 0.0×1/8 + 0.0×1/8 + 0.0×1/8 + 0.0×1/8 + 0.0×1/8 = 0% + 0% + 0% + 0% + 0% + 0% + 0% + 0%
Feedback:

Question 5: Score 0.66/4

You are to find the quadratic polynomial $y(t) = a_0 + a_1 t + a_2 t^2$ which is the best least squares approximation to the data.

i	1	2	3	4	5
t_i	0	0.5	1	1.5	2
y_i	2.1	1.5	0.7	1.4	1.4

Define the **column** vectors tdat and ydat, containing the data t_i and y_i respectively.

a) Give the MATLAB command(s) you used to create tdat.

tdat =

Your response	Correct response
No answer	**[0, .5, 1, 1.5, 2]**

Grade: 0/1.0

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b) Create the coefficient matrix A for a linear least squares problem $A\mathbf{x} = \mathbf{y}$ to find the parameter vector $\mathbf{x} = [a_0, a_1, a_2]^T$.

c) What is the 2-norm condition number of $A?_2(A) =$

Your response	Correct response
45	**14.4994±0.05**

Grade: 0/1.0

d) Find the least squares solution $\mathbf{x}^*$ to $A\mathbf{x} = \mathbf{y}$. Enter your solution as a **column** vector.

$x^* =$

Your response	Correct response
No answer	**Vector[column](3,{1 = 2.10571428571428, 2 = -1.84285714285713, 3 = .771428571428566},datatype = float[8],storage = rectangular,order = Fortran_order,shape = [])**

Grade: 0/1.0

e) Write down the approximating polynomial $y(t)$.

$y(t) =$

Your response	Correct response
No answer	**2.10571428571428-1.84285714285713*t+.771428571428566*t^2**

Grade: 0/1.0

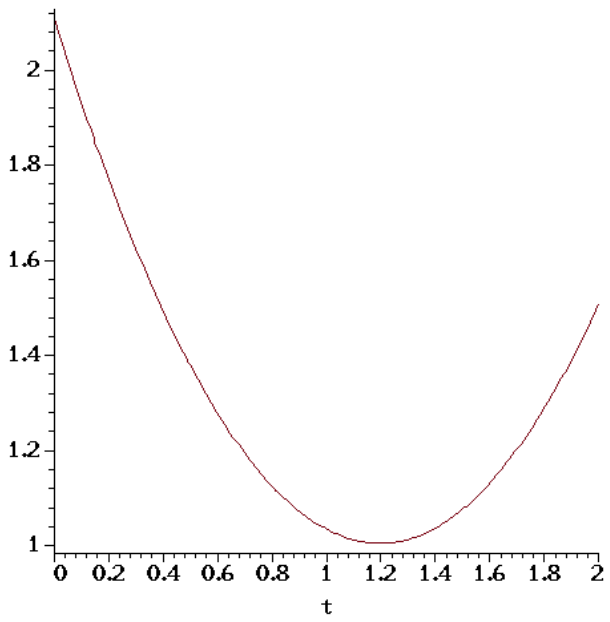
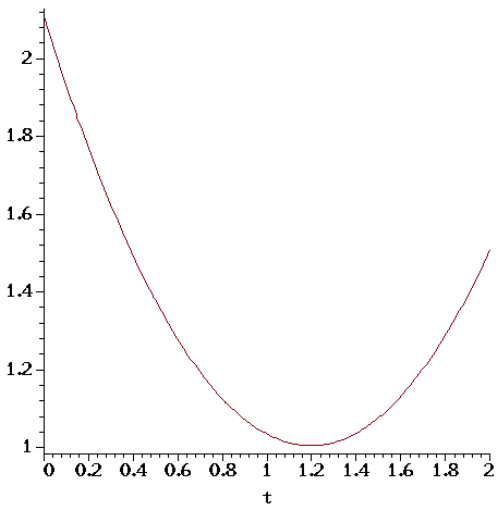
f) Use your polynomial to approximate $y(1.2)$

$y(1.2) \approx$

Your response	Correct response
78	**1.005143±0.001**

Grade: 0/1.0

g) Which of the following is the result of plotting your function y?

Your response	Correct response
	

Grade: 1/1.0

Total grade: 0.0×1/6 + 0.0×1/6 + 0.0×1/6 + 0.0×1/6 + 0.0×1/6 + 1.0×1/6 = 0% + 0% + 0% + 0% + 0% + 17%

Feedback: