PASS

PEER ASSISTED STUDY SESSIONS

MOCK EXAM

FOR PRACTICE ONLY

COURSE: ECOR 2606 **FACILITATOR:** Neil Douglas

It is **most beneficial** to you to write this mock midterm **UNDER EXAM CONDITIONS**. This means:

- Complete the midterm in **3** hour(s).
- Work on your own.
- Keep your notes and textbook closed.
- Attempt every question.

After the time limit, go back over your work with a different colour or on a separate piece of paper and try to do the questions you are unsure of. Record your ideas in the margins to remind yourself of what you were thinking when you take it up at PASS.

The purpose of this mock exam is to give you practice answering questions in a timed setting and to help you to gauge which aspects of the course content you know well and which are in need of further development and review. Use this mock exam as a ***learning tool*** in preparing for the actual exam.

Please note:

- Come to the PASS workshop with your mock exam complete. During the workshop you can work with other students to review your work.
- Often, there is not enough time to review the entire exam in the PASS workshop. Decide which questions you most want to review – the Facilitator may ask students to vote on which questions they want to discuss in detail.
- Facilitators do not bring copies of the mock exam to the session. Please print out and complete the exam before you attend.
- **Facilitators do not produce or distribute an answer key for mock exams.** Facilitators help students to work together to compare and assess the answers they have. If you are not able to attend the PASS workshop, you can work alone or with others in the class.

Good Luck writing the Mock Exam!!

Dates and locations of mock exam take-up: Mon., Oct. 16 6pm to 9pm (MC2000)

Section 1 – MATLAB Part 1

P1.1 Write a MATLAB function that will calculate the roots of a polynomial represented by row vector p and output the absolute value of the one with the greatest absolute value. It should return an error if length(p) is not greater than 1.

The first line of the function should be:

Function [rmax] =Maxroot(p)

P1.2 Write a script file (or void function file) that will calculate the greatest absolute value of f(x)= x^3+k x^2- 1/k x +2 for k=1, 3, 5, ...15 and print the results in a nicely formated table. You may want to make use of Maxroot.

Section 2 – MATLAB Part 2

P2.1 Write a MATLAB function that will return the difference between the maximum and minimum y values of a function f over an interval [xl, xu]. It should also plot f. It should return an error if xu is not 2 greater than xl. The first line of the function should be:

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function [diff]=diffy(f,xl, xu)
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P2.2 Write a script file (or void function file) that will calculate difference between the maximum and minimum values of f(x)= x^3-2 x^2- 1/2 x +2 over the domains x=[k-1 k+1] for k=0:10, plot each function and print the results in a nicely formatted table. You may want to make use of diffy.

Bonus MATLAB Problems

The problems below are some additional good practice for the midterm. We will get to it if we have time.

B1 Create the vector, p=[8 16 24 32 40 48 56 64] in MATLAB using the following three methods: colon notation, linspace function and for loop.

B2 Make the minimum number of changes necessary to make the following MATLAB expressions vector-friendly. Let x and z be vectors of the same size.

y = 3.*x.^2 – 2/(x*z) + z.^2;

w=((x^z + 6*2)/4 + 10./exp(x) – cos(x).*sin(x))/8;

B3 Write the MATLAB code necessary to find the coordinates (x,y) of the points of intersection between $y = x^2 + 3x^2 - 4$ and $y = -10x^2 - x + 2$. Pretend you've already plotted the functions and know that intersection occurs between x=0.5 and x=1.5 and between x=-0.5 and x=-1.5.

B4 For the function y = sin(x^2) – cos(x^2) – $\frac{1}{2}$, use MATLAB to find the coordinates (x,y) of the local maximum between x=2.5 and x=2.8 and the coordinates (x,y) of the local minimum between x=1.6 and x=2.2. Output all answers in a nicely formatted sentence.

For this problem I ask that you use fminbnd only to help you find the local maximum. You must determine a way to find the local minimum that does not involve using fminbnd.

Section 3 – Bisection Search

We will use a Bisection Search to find a root of $x^2 + 4x = 8$.

Root-finding form: ________________________

$f(-9) =$ ____________

$f(-3) =$ ____________

Step	X_L	X_U	X_R	$f(X_R)$	E_{MAX}
1	-9.000	-3.000			
2					
3					

Logic:

Formulas:

P3.1 What is the purpose of calculating $f(-9)$ and $f(-3)$ at the beginning?

P3.2 What are the values for Step 2 in the table above?

(a) -6.000; -3.000; -4.500; -5.750; 1.500

(b) -9.000; -6.000; -7.500; 18.250; 1.500

(c) -6.000; -3.000; -1.500; -11.75; -4.500

P3.3 What is our best guess at the root after three iterations?

(a) -6.000

(b) -5.250

(c) -1.438

(d) -4.500

P3.4 How many total steps will it take to reduce E_{MAX} to less than 0.01?

(a) 7

(b) 8

(c) 9

(d) 10

P3.5 What is the maximum error on the root after 7 iterations?

(a) 0.47

(b) 0.047

(c) 0.0047

(d) 4.7

Section 4 – False-Position Search

We will use a False-Position Search to find a root of $f(x) = \sin(x) + \cos(3x)$.

For this problem, put your calculators in radians.

$f(2.1)$ = _______________

$f(3.1)$ = _______________

Step	X_L	X_H	X_R	f(X_R)
1	2.100	3.100		
2				

Logic:

Formulas:

P4.1 What are the values for Step 2 in the table above?

(a) 2.100; 2.762; 2.745; 0.014

(b) 2.762; 3.100; 2.745; 0.014

(c) 2.100; 2.762; 2.431; 1.184

P4.2 We set up a False-Position Search with the initial bracketing points, X_L and X_H. If $f(X_L) * f(X_H)$ is a positive value, will we be able to find the root of the function using these bracketing points?

(a) Yes. Perform False-Position Search like you normally would and you will converge on the root.

(b) Yes, because a root is guaranteed to lie between X_L and X_H.

(c) No, because there is no root located between X_L and X_H.

(d) Yes, because the only way a root would not lie between these two points is if we had a vertical asymptote.

Section 5 – Newton-Raphson Search

We will use a Newton-Raphson Search to find a root of $f(x) = x^3 + 2x^2 - 5$.

$f'(x) =$ ______________________

Step	X_i	$f(X_i)$	$f'(X_i)$	E_a
0	0.500			
1				
2				

Formulas:

P5.1 What is our best guess at the root and the approximate error on this root after 2 steps?

(a) 2.091; 1.591

(b) 1.491; 0.600

(c) 1.491; -0.600

P5.2 What is the relative error on the root in Step 2?

(a) 0.600

(b) -0.600

(c) -40.241%

(d) 40.241%

P5.3 What does it mean if $f'(X_i)$ = 0 at any point in our search? (Assume X_i is not a root of the function)

(a) Newton-Raphson Search has failed (i.e. it won't find the root)

(b) The root of the function does not exist

(c) You will still be able to find the root if you continue with the Newton-Raphson Search

Section 6 – Secant Search

We will use the Secant Search to find a root of $x^2 - 6 = 2x$.

Root-finding form: ______________________________

Step	X_{k-1}	X_k	X_{k+1}	f(X_{k+1})	E_a
1	-2.000	1.000			
2					
3					

Formulas:

P6.1 What are the values for X_{k-1} and X_k in Step 2?

(a) -2.000; 1.000

(b) 1.000; -1.333

(c) N/A; -1.333

(d) -2.000; -1.333

P6.2 What is our best guess at the root after 3 steps?

(a) -1.625

(b) -0.109

(c) -2.000

(d) -1.333

P6.3 Secant Search would fail if f(X_{k-1}) = f(X_k). True or false?

(a) True

(b) False

Section 7 – Golden Section Search

We will use Golden Section Search to find the minimum of $f(x) = x^2 + 10x - 5$.

Step	xL	x2	x1	xU	f(xL)	f(x2)	f(x1)	f(xU)	Emax
1	-9.00			-2.00					
2									

Formulas:

Logic:

P7.1 The values in Step 1 of the Golden Section Search are:

(a) -9.00; -6.33; -4.67; -2.00; -14.00; -28.23; -29.89; -21.00; 3.50

(b) -9.00; -6.33; -4.67; -2.00; -14.00; -28.23; -29.89; -21.00; -0.83

(c) -9.00; -4.67; -6.33; -2.00; -14.00; -28.23; -29.89; -21.00; 3.50

(d) -9.00; -4.67; -6.33; -2.00; -14.00; -28.23; -29.89; -21.00; 0.83

P7.2 The values in the non-shaded boxes in Step 2 are:

(a) -6.33; -4.67; -2.00; -2.00; 2.16

(b) -9.00; -7.35; -6.33; -4.67; 2.16

(c) -6.33; -4.67; -3.65; -2.00; 2.16

(d) -6.33; -4.67; -3.65; -2.00; 1.33

P7.3 You are performing a Golden Section Search. Initially, x_U=3.020 and x_2=1.080. What are x_L and E_{MAX}?

(a) -1.201; 2.111

(b) 1.201; 0.910

(c) 0.119; 1.451

(d) -0.119; 1.570

P7.4 How would you use Golden Section Search to find the maximum of a function?

Did we miss anything?

Good luck on the midterm! You're going to do great!