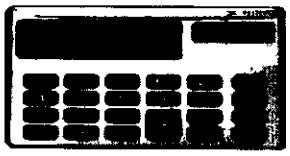
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

APM1513
APM113U

May/June 2010

APPLIED LINEAR ALGEBRA

Duration 2 Hours

100 Marks

EXAMINERS :
FIRST DR JM MANALE
SECOND MR AS KUBEKA

Use of a non-programmable pocket calculator is permissible

This paper consists of 4 pages

INSTRUCTIONS TO CANDIDATES

Answer all questions.

QUESTION 1

(a) (i) What is the difference between Octave and Matlab? (2)

(ii) What does the following statement do?

"C:/Documents and Settings/User/My Documents/apm113"

(3)

(iii) What is a Home directory? (2)

(iv) What is an M-file? (2)

(v) The Octave 'Help' facility (menu) is used for what purpose? (2)

(vi) How will you use the 'Help' menu to evaluate $\sqrt{2}$ to 15 significant figures? (3)

(b) Write an M-file for the following Octave/Matlab problems.

(i) For plotting a graph of $cos(x)$ in the range $-1 < x < 5$ (2)

(ii) For evaluating

$$\frac{\sqrt{7\,3}}{2.4^3 + 3.1}. \quad (3)$$

(iii) For solving the simultaneous equations

$$2x_1 + 3x_2 = 10,$$
$$4x_1 + 5x_2 = 8$$

(6)

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QUESTION 2

(a) Given the following Octave/Matlab code,

Code:

$n = 10$
$fact = 1; 5$
$for\ k = 1 \quad n$
$fact = k^* fact,$
$factorials\,(k,\ ) = [k\ fact],$
end
$factorials$

answer the following questions,

(i) What does the *for loop* in the above code do? (Write a short paragraph detailing all the computations involved) (6)

(ii) List the final computed results (3)

(iii) Write a simple *for loop* code to evaluate the following series

$$1^2 + 2^2 + 3^2 + .\ + 100^2. \quad (5)$$

(b) A bank wants to calculate the interest due to its customers and add this to their accounts This is complicated since the interest rate applicable depends on the initial balance as follows

Initial balance	Interest rate
Less than R1000	0%
R1000 to R5000	5%
R5000 to R10000	8%
R10000 to R20000	9%
Above R20000	10%

(i) Write the Octave/Matlab code for the above problem using the *if statement* is:

if (CONDITION)
statements
elseif (CONDITION)
statements
elseif (CONDITION)
statements
...
else (CONDITION)
statements
endif (11)

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QUESTION 3

(a) Consider the equation

$$AX = B$$

where $X^T = (x_1, x_2, ..., x_n)$ and $B^T = (b_1, b_2, ..., b_n)$ are $1 \times n$ vectors, and A an $n \times n$ matrix.

(i) Write Octave/MatLab commands that can be used to capture A and B into the computer memory. (5)

(ii) Write Octave/MatLab command(s) that replaces the ith column of A with B. (5)

(iii) Express the ratio $\frac{B}{A}$ in Octave/MatLab using \ and /. (2)

(b) Consider the system of equations

$$\begin{aligned} 3x_1 + 4x_2 + 5x_3 &= 4 \\ 6x_1 + 2x_2 + 3x_3 &= 7 \\ x_1 + 3x_2 + 3x_3 &= 1. \end{aligned}$$

(i) Solve the system by **Gaussian** elimination *with pivoting*, round to *four significant figures*. (7)

(ii) Find the exact solution by **Gaussian** elimination *without pivoting*. (7)

[26]

QUESTION 4

Use the *simplex* method to solve the following linear programming problem:
Maximize

$$L = x_1 + 1\ 6x_2$$

subject to the constraints

$$\begin{aligned} -x_1 - 3x_2 \geq= & \ -12 \\ -1.5x_1 - x_2 \geq & \ -7.5 \\ x_1, x_2 \geq & \ 0 \end{aligned}$$

Give a full *geometrical* interpretation of your solution.

[24]

TOTAL MARKS: [100]