Tutorial Letter 501/3/2014

APPLIED LINEAR ALGEBRA

APM1513

Semesters 1 & 2

Department of Mathematical Sciences

IMPORTANT INFORMATION:

This tutorial letter contains important information about your course.

BAR CODE

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FIRST SEMESTER STARTS: 15th JANUARY FOR APM1513

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1.1.1 MATLAB or Octave
1.1.2 Installation of Octave
1.1.3 Testing simple examples in the program
1.1.4 Exit
1.2 Process to input files to the program, Octave
1.2.1 Create a storage folder 1.2.2 Using m files
1.3 Output from an Octave session
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1.5 In conclusion

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2.5 Miscellaneous features of Octave
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2.5.3 Several statements on the same line
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2.5.5 Input statement
2.5.6 Complex numbers
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2.6.3 If statements
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2.6.5 Conditional loops
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2.7.3 Function handles

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2.8.3 Plotting lines in 3-dimensions with plot3
2.8.4 Other features of graphics
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Study Unit 3:

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3.2 Gaussian elimination
3.3 Iterative methods

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3.4 Diagonal dominance
3.4.1 Stopping criterion
3.5 Exceptional cases (where the solution may not be reliable)
3.6 Additional exercises
3.7 In conclusion

Study Unit 4:

4.1 Identification of overderdertermined and underderdertermined systems
4.1.1 A is square ($m = n$) and $det(A) \neq 0$
4.1.2 A is square ($m = n$) and $det(A) = 0$
4.1.3 There are more equations than unknowns ($m > n$)
4.1.4 There are more unknown than equations ($n > m$)

WEEK 6: 19 Feb - 25 Feb

4.2 Overdertermined systems
4.3 Underdertermined systems
4.4 Underdertermined and inconsistent system
4.5 Additional exercises
4.6 In conclusion

ASSIGNMENT 1 IS DUE ON THE 14th FEBRUARY

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Study Unit 5:

5.4 The power method
5.4.1 Algorithm
5.4.2 Justification/why
5.5 Additional exercises
5.6 In conclusion

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Study Unit 6:

6.1 The basic ideas of linear programing
6.2 The simplex method
6.3 The Octave glpk "package" 6.4 More realistic linear programming examples
6.5 Additional exercises
6.6 In conclusion

WEEKLY OUTCOMES

WEEK 1: 15 JAN - 21 JAN

Students should know how:

- to instal MATLAB or Octave program,
- to copy and past to the clipboard,
- to use the help menu function and all other toolbars on MATLAB and Octave,
- to use a Diary file,
- to do basic symbolic and numerical computation with MATLAB or Octave,
- to define and create the *m*-file,
- to create variables and assigning numerical values to them,
- to create vectors and matrices and how to access rows and columns of a matrix.

WEEK 2: 22 JAN -28 JAN

Students should know how:

- to create vectors and matrices
- to perform the matrix addition, subtraction, multiplication, and division,
- to construct inverse of a matrix,
- to perform the calculations for square matrix for a given power of n i.e. how to raise a matrix to a power n,
- to do computations on matrix arrays,
- to use the 'disp' command.

WEEK 3: 29 JAN - 04 FEB

Students should know how:

- to use the "***for loops***" to compile a working code/program,
- to use the matrix or array operations versus "***for loops***",
- to use the "***if statements***" to compile a working code/program,
- to use conditional statements to evaluate conditions by using "***conditional loops***" and the following operations,

Octave code	Mathematical meaning
$<$	$<$
$<=$	$\leq$
$>$	$>$
$>=$	$\geq$
$==$	$=$
&	and
|	or

  − for example, if you want to test for equality, use == rather than =, i.e.

$$> \text{if } (a == b)$$

  - Also, the Octave equivalent of, if $(a < x < b)$ is

$$\text{if } ((a < x) \ \& \ (x < b)).$$

- to define a function or functions

WEEK 4: 05 FEB - 11 FEB

Students should know how:

- to plot functions using "fplot" command,
- to plot functions using the "plot" command, in 2-dimensions,
- to change the default colour of the graph,
- to draw graphs of several functions in the same plot,
- to give the graph a title,
- to label the axes,
- to give a legend to a curve,
- to plot in 3-dimensions using the "plot3" command,
- to plot surfaces in 3-dimensions using the "mesh" command,
- to plot contours in 2, 3-dimensions using the "contour" command,
- to plot a surface and its contour plot on the same plot using "meshc(xx,yy,zz)"
- to use the construct $x = A\backslash b$ to solve a system of equations,

ASSIGNMENT 1 IS DUE ON 15th AUGUST

WEEK 5: 12 FEB- 18 FEB

Students should know how:

- to use the Gauss Seidel code to solve a system of equations for iterative methods,
- to determine if a matrix A is strictly diagonally dominant,
- to use the iterative linear solver code to solve a system of equations,
- to implement the stopping criteria condition in a code,
- to identify overdetermined and underdetermined systems,

WEEK 6: 19 FEB - 25 FEB

Students should know how:

- to identify overdetermined systems,
- to fine the best fitting curve for a given data,
- to identify underdetermined systems,
- to identify underdertermined and inconsistent system.

WEEK 7: 26 FEB - 01 MARCH

Students should know how:

- to calculate eigenvalues and eigenvectors using the Octave command "eig",
- to diagonalize a matrix using the "inv" command,

ASSIGNMENT 2 IS DUE ON 15th SEPTEMBER

WEEK 8: 02 March - 08 March

Students should know how:

- to use the power code and know the outlined power method theory

WEEK 9: 09 March - 15 March

- Understand the basic concepts of linear programming,
- Use the Octave package "glpk" to solve problems in linear programming,
- Ex-press realistic problems in mathematical terms, and then use the Octave package "glpk" to solve them

ASSIGNMENT 2 IS DUE ON 14th MARCH

ASSIGNMENT 3 IS DUE ON 09th APRIL

REVISION STARTS ON 10th April

END OF THE COURSE FOR FIRST SEMESTER

SECOND SEMESTER STARTS: 8th JULY FOR APM1513

ONLINE COURSE OUTLINE

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WEEK 4: 29 July - 4 August

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WEEK 8: 26 August - 1 September

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ASSIGNMENT 3 IS DUE ON 25th SEPTEMBER

REVISION STARTS ON 25th SEPTEMBER

END OF THE COURSE FOR SECOND SEMESTER