

# DEPARTMENT OF INFORMATION TECHNOLOGY, NITK SURATHKAL

## SAMPLE LAB ASSIGNMENT

### IT464: FOUNDATIONS OF MACHINE LEARNING

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Write a Python program to answer the following

1. Generate a matrix with random entries of a size 4\*4 and find and show
  - i. The transpose of the matrix
  - ii. Inverse
  - iii. Trace
  - iv. Eigenvalues
  - v. Eigenvectors
2. Verify and show the adherence of the following vector operations to vector algebra laws (like commutative, associative, and distributive laws) by testing each law. Formulate a table to depict the results of this test.
  - (i) Vector addition
  - (ii) Vector subtraction
  - (iii) Scalar-Vector multiplication
  - (iv) Vector-Vector multiplication (Inner product)
3. Consider marks obtained by a class of Engg. students for three assignments, a mid-sem, one mini-project work and an end-sem are mentioned in .xlsx files that can be downloaded from the moodle portal to make the final report for grading the students of the class. Course evaluation plan is made by giving a weightage of 20% each to the assignments (for all the three), the mid-sem exam and the mini-project work. Remaining 40% weightage is given to the end-sem exam. Now using the vector operations calculate and show the final consolidated marks (normalized to hundred) of the class using vector operations.

**Statics to show/display:**

  - i. Final scores of each assignment, mid, end-sem and project after normalization of final score to 100.
  - (ii). Find mean, variance and standard deviation along with the maximum and minimum of the normalization final marks.
  - (iii) Apply barchart on #students obtaining scores in different ranges like 0-10, 11-20,...,91-100.
  - (iv) Apply barchart for the score ranges 100-81, 80-74, 73-63, 62-50, 49-38, 36-27 and 26-20 to find the number of students obtained the scores in those ranges.
  - (v) Plot the marks distribution of the students using Normal distribution
4. Compute linear combinations of the following vectors to find the span and visualize the vector span in a higher dimensional plane.
  - (i)  $U = [1 \ 0]$ ;  $V=[0 \ 1]$ ;
  - (ii)  $U = [1 \ 2]$ ;  $V=[1 \ 3]$ ;

**Note:** Linear combinations  $L1*U + L2*V \geq 0$ , where  $L1, L2 \geq 0$ ,  $L1, L2 \leq 1$ , and  $L1+L2 = 1$ .
5. Generate a random matrix of size 30\*50 and write a Python code to find the no.of independent vectors or columns of the matrix. Find the rank of the matrix using Python code. Make your comment.