

From exercises 1 and 2, choose one. Solve and explain your reasoning. If something is not clear, make an assumption and state it, then solve accordingly. The exam is to be solved individually and submitted by Monday at 8 am. You may hand it late, but you will receive a penalty. You will get credit for partially solved problems.

Name: \_\_\_\_\_

### Exercises

1. Recall from lecture 9 (Independent Component Analysis) the whitening transform given by the whitening matrix  $\mathbf{C}$  referred in slide 47. Implement in MATLAB the whitening transform. Test your implementation transforming the Iris data set, which can be downloaded by <ftp://ics.uci.edu/pub/machine-learning-databases/iris> or it is available in Matlab as `[x,t] = iris_dataset;`. Verify that the covariance matrix of the transformed data is the identity matrix.
2. Implement in MATLAB the K-Means algorithm and test it on the Iris Data set.
3. Why do we use cosine windows like the Hamming, Hanning, or Blackman windows for computing the DFT of signals? Give a graphical example.
4. Triaxial accelerometers are used for several interesting applications, like autonomous vehicles. Suppose we got data from a sinusoidal acceleration in a certain direction in the 3D space as shown in Fig. 1. Describe how Principal Component Analysis PCA (via Singular Value Decomposition SVD) could be applied to determine that direction.

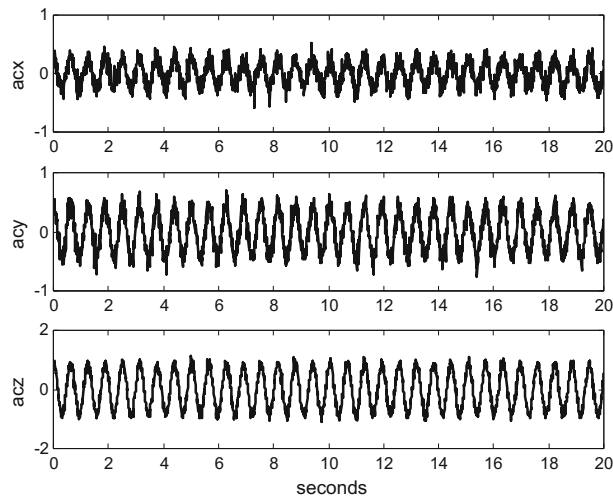


Figure 1: Signals from the 3 axis accelerometer.

5. Explain the differences between the Expectation Maximization (EM) algorithm and the K-means algorithm for the problem of classification. Give a graphical explanation.