**CSE301 Bio-computation, 2016**

**Tutorial Exercises (PCA learning, competitive learning)**

**Q1**. What can unsupervised learning be used for?

**Q2.** In competitive learning there is the so called .dead-unit problem. Give two ways to overcome this problem.

**Answer:** *Bookwork*

**Q3**. Is the following statement true or false? “Clustering can be useful when we want to analyse a large number of pattern vectors and identify groups of patterns with similar features.”

A. TRUE.

B. FALSE.

**Answer: A**

**Q4.** Is the following statement true or false? “Patterns within a cluster should be similar in some way.”

A. TRUE.

B. FALSE

**Answer: A**

**Q5.** Is the following statement true or false? “Clusters that are similar in some way should be far apart.”

A. TRUE.

B. FALSE.

**Answer: B**

**Q6**. We have the following three 9-dimensional data vectors:



What will the 9 eigenvalues be if we analyse the distribution with PCA?

**Q7.** Consider a competitive network with 4 inputs and 2 outputs having the weight matrix:



Compute the new weight matrix when the input [2 1 2 1]T is presented to the network. Assume learning rate parameter is 0.5.

**Q8.** Which of the following statements is NOT true for simple competitive learning (SCL)?

A. There is no target output in SCL.

B. There are no hidden units in a SCL network.

C. The input vectors are often normalized to have unit length — that is, || **x** ||= 1.

D. The weights of the winning unit k are adapted by Δ**w**k = η (**x** − **w**k), where x is the input vector.

E. The weights of the neighbours j of the winning unit are adapted by Δ**wj** = ηj (**x** − **wj**), where ηj < η and j ≠k.

**Answer:** E