CSCI4390/6390 – Data Mining
Fall 2007, Quiz 4
Total Points: 20

Name:____

1. (10 points) Given the covariance matrix $\mathbf{\Sigma} = \begin{pmatrix} 5 & 4 \\ 4 & 5 \end{pmatrix}$, Compute the eigenvalues of $\mathbf{\Sigma}$ by solving

   $$det(\mathbf{\Sigma} - \lambda\mathbf{I}) = 0$$

   Recall that the roots of a quadratic equation $ax^2 + bx + c = 0$ are given as

   $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

   For the case above you may also be able to solve it by a simple factorization.

2. (10 points) Given the covariance matrix $\mathbf{\Sigma} = \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$ whose eigenvalues are $\lambda_1 = 5$ and $\lambda_2 = 1$. Find the corresponding eigenvectors by solving

   $$\mathbf{\Sigma}\mathbf{u}_i = \lambda_i \mathbf{u}_i$$

   Note that you can first solve for any eigenvector (not necessarily of unit length), and then you can convert it into a unit vector by dividing by its magnitude.