

# Foundations of Numerical Methods (2<sup>nd</sup> term 2005)

## Exercise Sheet 3 - Systems of linear equations

1. Find the parabola  $y = A + Bx + Cx^2$  that passes through (1,4), (2,7) and (3,14) using the Gaussian elimination with backward substitution.
2. Find the row interchanges that are required to solve the following systems using Gaussian elimination with backward substitution (assume that the only permutation performed is to swap two rows of the extended matrix if  $a_{kk}^{(k)} = 0$ ).

$$\begin{array}{l} x_1 + x_2 - x_3 = 1 \\ \text{(a) } x_1 + x_2 + 4x_3 = 2 \\ 2x_1 - x_2 + 2x_3 = 3 \end{array}$$

$$\begin{array}{l} x_2 + x_3 = 6 \\ \text{(b) } x_1 - 2x_2 - x_3 = 4 \\ x_1 - x_2 + x_3 = 5 \end{array}$$

3. Construct a flow chart and an algorithm for the Gaussian elimination with backward substitution incorporating the pivoting strategy discussed in class i) to avoid dividing by zero and ii) to reduce the round-off error.  
Hints: you will need a few if statements, and an auxiliary vector.