21-241 **Groupwork 2** **September 10, 2015**

Answer the questions below. You may answer in the space provided. You may use a separate sheet of paper if you need more space. You are to work in groups of no more than four people. Make sure to enter the names of your groupmates below. You must show your work for full credit.

Name: _____

Section: _____

Group Members: _____

1. For this problem, you will find the points of intersection for two planes in $\mathbb{R}^3$. Consider the planes given by the equations

$$4x + y + z = 0$$

$$2x - y + 3z = 2$$

(a) (2 points) Write the augmented matrix for the system of linear equations you need to solve.

(b) (2 points) Using elementary row operations, find a row-equivalent matrix for the matrix in part (a) that is in row echelon form.

(c) (1 point) What are the points on both planes?

2. Suppose we have two lines in $\mathbb{R}^3$, $\mathbf{x} = \mathbf{p} + t\mathbf{u}$ and $\mathbf{x} = \mathbf{q} + s\mathbf{v}$. Note that we use two different parameters because the two parameters in the equations are independent of each other. For points of intersection, we have that $\mathbf{p} + t\mathbf{u} = \mathbf{q} + s\mathbf{v}$, or $t\mathbf{u} - s\mathbf{v} = \mathbf{q} - \mathbf{p}$. Using the system of equations from equating the components, we can solve for s and t, and use this to find any points of intersection.

   (a) (2 points) Let $\mathbf{p} = \begin{bmatrix} 3 \\ 1 \\ 0 \end{bmatrix}$, $\mathbf{q} = \begin{bmatrix} -1 \\ 1 \\ -1 \end{bmatrix}$, $\mathbf{u} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$, and $\mathbf{v} = \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}$. Write the system of equations and the augmented matrix that you need to solve for the intersection.

   (b) (2 points) Put the augmented matrix into row echelon form.

   (c) (1 point) What is the intersection, if any?