

Place your name on the back of this sheet of paper and nowhere else. Staple your answers face up on the front of this sheet of paper. Failure to follow these directions will cost you 1 point. If you use double-sided printing or print on the back of scrap paper, I will give you one additional point.

**Show all work.**

1) (35 points) Suppose the demand for hats is given by  $D_H = 81 - 10P_H + P_C - P_F$ , the demand for coats is given by  $D_C = 100 - 20P_C$ , the demand for fans is given by  $D_F = 19 + P_H - P_C - 2P_F$ , and the supply curves are  $S_H = -10 + 20P_H$ ,  $S_C = -5 + 3P_C$ , and  $S_F = -1 + P_F$ . Write the equations in the form of  $\mathbf{Ax}=\mathbf{b}$ . Find  $A^{-1}$  by using the adjoint. Use that to calculate the equilibrium values for the prices and quantities.

2) (10 points each) Find the determinants of the following matrices. Note that in some cases, you may want to transpose the matrix, swap rows, swap columns, add a multiple of a row to another row, and/or add a multiple of a column to another column, before finding the determinant.

Remember what those actions do to the determinant.

$$A = \begin{bmatrix} 3 & 2 & 0 \\ 1 & 4 & 5 \\ -2 & -3 & 0 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & 0 & 4 \\ -2 & 0 & 5 \\ 3 & -2 & 1 \end{bmatrix}$$

$$C = \begin{bmatrix} 2 & 4 & 6 \\ 1 & 2 & 3 \\ 5 & 10 & 15 \end{bmatrix}$$

3) (35 points) Suppose the demand for hats is given by  $D_H = 100 - 6P_H + 2P_F$ , the demand for coats is given by  $D_C = 200 - 10P_C + 20P_H$ , the demand for fans is given by  $D_F = 305 + P_H - P_C - 2P_F$ , and the supply curves are  $S_H = -20 + 120P_H$ ,  $S_C = -20 + 110P_C$ , and  $S_F = -30 + 110P_F$ . Write the equations in the form of  $\mathbf{Ax}=\mathbf{b}$ . Find  $A^{-1}$  by using the adjoint. Use that to calculate the equilibrium values for the prices and quantities.