The following topics and skills will be examined in the first midterm test.

- Solving 2×2 systems.
- Demand and supply curves.
- Converting between augmented matrices and systems of equations.
- Rewriting systems of equations as matrix equations.
- Writing packaging problems, RST games and similar problems as systems of equations.
- Solving 3×3 and 2×2 systems by the methods of Gauss-Jordan elimination and matrix inversion.
- Systems of equations with no solutions and with many solutions.
- Matrix addition, multiplication and multiplication of a matrix by a real number.
- Finding the inverses of 2×2 and 3×3 matrices.

Below are some sample questions to help you prepare for the exam. Be sure that you understand all of the topics from the above list, not just the topics covered by the questions below! In your answers, please be sure to 1) Check answers when possible. 2) Clearly indicate your answer and the reasoning used to arrive at that answer. Unsupported answers will receive no credit. 3) Label all variables and equations.

1. The following information is available regarding the supply, demand and price of new and improved β-widgets.

Supply	Demand	
100	60	\$10
125	35	\$12
150	10	\$15

   (a) Plot this information on a graph.

   (b) Estimate the equilibrium price.

   (c) If the price is \$15, is there shortage or surplus?

2. Suppose that a company produce packages of nuts which contain cashews, peanuts and filberts. The D-package contains 4 ounces of cashews, 3 oz. of peanuts and 1 oz. of filberts. The L-package contains 1 oz. of cashews, 3 oz. of peanuts and 1 oz. of filberts. The E-package contains 2 oz. of cashews, 3 oz. of peanut and no filberts. Suppose that next month they expect to have 100

pounds of cashews, 200 pounds of peanuts and 150 pounds of filberts. Set up a system of equations whose solution tells how many of each package they can make while using up all of the available nuts. Do not solve this system.

3. (a) Find the inverse of $\begin{pmatrix} 3 & 1 & 1 \\ 1 & 1 & 1 \\ 2 & 2 & 0 \end{pmatrix}$

   (b) Use your answer to part a to solve the following system.

$$\begin{aligned} 3x + y + z &= 2 \\ x + y + z &= 1 \\ 2x + 2y &= 4 \end{aligned}$$

4. (a) Solve

$$\begin{aligned} x + y - z &= 2 \\ y + z &= 2 \\ x + 3y + z &= 6 \end{aligned}$$

   (b) Solve

$$\begin{aligned} x + 2y &= 1 \\ 2x + y &= 1 \end{aligned}$$

5. For each of the following matrix operations, either give the result or explain why it is impossible.

$$\begin{pmatrix} 1 & 2 \\ 4 & -1 \end{pmatrix} \begin{pmatrix} 2 \\ 3 \end{pmatrix}, \quad \begin{pmatrix} 1 & 2 \\ 4 & -1 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix}, \quad \begin{pmatrix} 2 \\ -1 \end{pmatrix} \begin{pmatrix} 2 & 3 \end{pmatrix}.$$

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