6.6 EXERCISES

PRACTICE

1. The input-output matrix A and corresponding demand matrix E for a local economy are given.

$$A = \begin{matrix} \\ \text{Agriculture} \\ \text{Manufacturing} \end{matrix}\begin{matrix} \begin{matrix} \text{A} & \text{M} \end{matrix} \\ \begin{bmatrix} 0.7 & 0.1 \\ 0.2 & 0.6 \end{bmatrix} \end{matrix}, \quad E = \begin{bmatrix} 8000 \\ 5000 \end{bmatrix}$$

a. Identify the inputs needed from each industry to produce one unit of output from manufacturing.
b. Identify the inputs needed from each industry to produce 3 units of output from agriculture.
c. Find $I - A$ and $(I - A)^{-1}$.
d. Find the production matrix X.

2. The input-output matrix A and corresponding demand matrix E for a local real estate market are given.

$$A = \begin{matrix} \\ \text{Apartments} \\ \text{Single-Family Homes} \end{matrix}\begin{matrix} \begin{matrix} \text{A} & \text{S} \end{matrix} \\ \begin{bmatrix} 0.4 & 0.3 \\ 0.3 & 0.1 \end{bmatrix} \end{matrix}, \quad E = \begin{bmatrix} 900 \\ 600 \end{bmatrix}$$

a. Identify the inputs needed from each industry to produce one unit of output from single-family homes.
b. Identify the inputs needed from each industry to produce 4 units of output from apartments.
c. Find $I - A$ and $(I - A)^{-1}$.
d. Find the production matrix X.

3. The input-output matrix A and corresponding demand matrix E for a local economy market are given.

$$A = \begin{matrix} \\ \text{Agriculture} \\ \text{Mining} \\ \text{Manufacturing} \end{matrix}\begin{matrix} \begin{matrix} \text{A} & \text{Mi} & \text{Ma} \end{matrix} \\ \begin{bmatrix} 0.1 & 0.2 & 0.3 \\ 0.1 & 0.2 & 0.3 \\ 0.1 & 0.2 & 0.3 \end{bmatrix} \end{matrix}, \quad E = \begin{bmatrix} 400 \\ 1200 \\ 800 \end{bmatrix}$$

a. Identify the inputs needed from each industry to produce one unit of output from agriculture.
b. Identify the inputs needed from each industry to produce 2 units of output from mining.
c. Find $I - A$ and $(I - A)^{-1}$.
d. Find the production matrix X.

4. The input-output matrix A and corresponding demand matrix E for a local real estate market are given.

$$A = \begin{matrix} \\ \text{Single-Family} \\ \text{Multi-Family} \\ \text{Rental} \end{matrix} \begin{matrix} \begin{matrix} \text{S} & \text{M} & \text{R} \end{matrix} \\ \begin{bmatrix} 0.2 & 0.3 & 0.3 \\ 0.1 & 0.2 & 0.2 \\ 0.1 & 0.1 & 0.1 \end{bmatrix} \end{matrix}, \quad E = \begin{bmatrix} 600 \\ 200 \\ 400 \end{bmatrix}$$

a. Identify the inputs needed from each industry to produce one unit of output from rentals.
b. Identify the inputs needed from each industry to produce 3 units of output from single family.
c. Find $I - A$ and $(I - A)^{-1}$.
d. Find the production matrix X.

Given the following input-output matrix *A* and corresponding production matrix *X*, find the external demand matrix *E*.

5. $$A = \begin{matrix} \\ \text{Hospitality} \\ \text{Health Care} \end{matrix} \begin{matrix} \begin{matrix} \text{H} & \text{HC} \end{matrix} \\ \begin{bmatrix} 0.3 & 0.1 \\ 0.5 & 0.5 \end{bmatrix} \end{matrix}, \quad X = \begin{bmatrix} 1700 \\ 2900 \end{bmatrix}$$

6. $$A = \begin{matrix} \\ \text{Construction} \\ \text{Manufacturing} \end{matrix} \begin{matrix} \begin{matrix} \text{C} & \text{M} \end{matrix} \\ \begin{bmatrix} 0.4 & 0.2 \\ 0.5 & 0.5 \end{bmatrix} \end{matrix}, \quad X = \begin{bmatrix} 2200 \\ 2600 \end{bmatrix}$$

7. $$A = \begin{matrix} \\ \text{Coal} \\ \text{Oil} \\ \text{Natural Gas} \end{matrix} \begin{matrix} \begin{matrix} \text{C} & \text{O} & \text{G} \end{matrix} \\ \begin{bmatrix} 0.4 & 0.2 & 0 \\ 0.3 & 0.3 & 0.3 \\ 0.2 & 0.1 & 0.3 \end{bmatrix} \end{matrix}, \quad X = \begin{bmatrix} 800 \\ 1200 \\ 600 \end{bmatrix}$$

8. $$A = \begin{matrix} \\ \text{Computers} \\ \text{Automobiles} \\ \text{Aircraft} \end{matrix} \begin{matrix} \begin{matrix} \text{C} & \text{Au} & \text{Ai} \end{matrix} \\ \begin{bmatrix} 0.2 & 0.3 & 0.1 \\ 0.1 & 0.4 & 0.2 \\ 0.6 & 0.2 & 0.3 \end{bmatrix} \end{matrix}, \quad X = \begin{bmatrix} 800 \\ 600 \\ 1000 \end{bmatrix}$$

APPLICATIONS

9. Suppose that in a certain local economy we have manufacturing and agriculture industries. To produce one dollar in output, each industry needs the following input.

- The manufacturing industry requires \$0.10 from itself and \$0.30 from agriculture.
- The agriculture industry requires \$0.30 from manufacturing and \$0.40 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$300 in manufacturing and \$600 in agriculture. Solve for the production necessary to meet these internal and surplus demands.

10. Suppose that in a certain local economy we have natural gas and coal industries. To produce one dollar in output, each industry needs the following input.

- The natural gas industry requires \$0.40 from itself and \$0.30 from coal.
- The coal industry requires \$0.20 from natural gas and \$0.40 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$600 in natural gas and \$900 in coal. Solve for the production necessary to meet these internal and surplus demands.

11. Suppose that in a certain local economy we have computer manufacturing and automobile manufacturing industries. To produce one dollar in output, each industry needs the following input.

- The computer manufacturing industry requires \$0.10 from itself and \$0.20 from automobile manufacturing.
- The automobile manufacturing industry requires \$0.20 from computer manufacturing and \$0.40 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$400 in computer manufacturing and \$800 in automobile manufacturing. Solve for the production necessary to meet these internal and surplus demands.

12. Suppose that in a certain local economy we have coal, oil, and natural gas industries. To produce one dollar in output, each industry needs the following input.

- The coal industry requires \$0.10 from itself, \$0.20 from oil, and \$0.30 from natural gas.
- The oil industry requires no input from coal, \$0.40 from itself, and \$0.20 from natural gas.
- The natural gas industry requires \$0.10 from coal, \$0.20 from oil, and \$0.30 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$10,000 in coal, \$10,000 in oil, and \$10,000 in natural gas. Solve for the production necessary to meet these internal and surplus demands.

13. Suppose that in a certain local entertainment economy we have museums, theaters, and sporting events industries. To produce one dollar in output, each industry needs the following input.

- The museum industry requires \$0.40 from itself, \$0.30 from theater, and \$0.20 from sporting events.
- The theater industry requires \$0.20 from museums, \$0.40 from itself, and \$0.30 from sporting events.
- The sporting events industry requires \$0.20 from museums, \$0.40 from theater, and \$0.30 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$500 in museums, \$750 in theaters, and \$400 in sporting events. Solve for the production necessary to meet these internal and surplus demands.

14. Suppose that in a certain local information economy we have media, data processing, and telephone company industries. To produce one dollar in output, each industry needs the following input.

- The media industry requires \$0.30 from itself, \$0.20 from data processing, and no input from telephone companies.
- The data processing industry requires \$0.40 from media, \$0.20 from itself, and \$0.10 from telephone companies.
- The telephone company industry requires \$0.10 from media, \$0.10 from data processing, and \$0.20 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$300 in media, \$300 in data processing, and \$300 in telephone companies. Solve for the production necessary to meet these internal and surplus demands.

15. Suppose that in a certain local health economy we have curative, rehabilitative, and preventative industries. To produce one dollar in output, each industry needs the following input.

- The curative industry requires \$0.20 from itself, \$0.10 from rehabilitative, and \$0.20 from preventative.
- The rehabilitative industry requires \$0.20 from curative, \$0.30 from itself, and \$0.20 from preventative.
- The preventative industry requires \$0.20 from curative, \$0.40 from rehabilitative, and \$0.20 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$500 in curative, \$1500 in rehabilitative, and \$1000 in preventative. Solve for the production necessary to meet these internal and surplus demands.

16. Suppose that in a certain local economy we have coal, gasoline, electric, and natural gas industries. To produce one dollar in output, each industry needs the following input.

- The coal industry requires \$0.10 from itself, \$0.20 from gasoline, no input from electric, and \$0.20 from natural gas.
- The gasoline industry requires \$0.40 from coal, \$0.10 from itself, no input from electric, and \$0.10 from natural gas.
- The electric industry requires no input from coal, \$0.10 from gasoline, \$0.20 from itself, and \$0.30 from natural gas.
- The natural gas industry requires \$0.20 from coal, \$0.10 from gasoline, no input from electric, and \$0.10 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$300 in coal, \$600 in gasoline, \$600 in electric, and \$900 in natural gas. Solve for the production necessary to meet these internal and surplus demands.

17. Suppose that in a certain local economy we have manufacturing, agricultural, health, and energy industries. To produce one dollar in output, each industry needs the following input.

- The manufacturing industry requires \$0.20 from itself, \$0.20 from agriculture, \$0.20 from health, and \$0.20 from energy.
- The agricultural industry requires \$0.20 from manufacturing, \$0.20 from itself, \$0.20 from health, and \$0.20 from energy.
- The health industry requires \$0.20 from manufacturing, \$0.20 from agriculture, \$0.20 from itself, and \$0.20 from energy.
- The energy industry requires \$0.10 from manufacturing, no input from agriculture, \$0.30 from health, and \$0.40 from itself.

Suppose further that in addition to the internal demand, there is a surplus demand from outside of the industries for \$1000 in manufacturing, \$500 in agriculture, \$500 in health, and \$500 in energy. Solve for the production necessary to meet these internal and surplus demands.

18. Suppose that in a certain local economy we have durable manufacturing and nondurable manufacturing industries. To produce one dollar in output, each industry needs the following input.

- The durable manufacturing industry requires \$0.10 from itself and \$0.30 from nondurable manufacturing.
- The nondurable manufacturing industry requires \$0.30 from durable manufacturing and \$0.60 from itself.

Suppose further that the total production capacity of durable manufacturing is \$500 and of nondurable manufacturing is \$800. Find the external demand.

19. Suppose that in a certain local economy we have agriculture, manufacturing, and energy industries. To produce one dollar in output, each industry needs the following input.

- The agriculture industry requires \$0.30 from itself, no input from manufacturing, and \$0.20 from energy.
- The manufacturing industry requires \$0.10 from agriculture, \$0.40 from itself, and \$0.20 from energy.
- The energy industry requires \$0.30 from agriculture, \$0.40 from manufacturing, and \$0.20 from itself.

Suppose further that the total production capacity of agriculture is \$800, of manufacturing is \$800, and of energy is \$1000. Find the external demand.

20. Suppose that in a certain local economy we have coal, gasoline, electric, and natural gas industries. To produce one dollar in output, each industry needs the following input.

- The coal industry requires \$0.30 from itself, \$0.20 from gasoline, \$0.10 from electric, and \$0.20 from natural gas.
- The gasoline industry requires \$0.20 from coal, \$0.10 from itself, \$0.10 from electric, and \$0.10 from natural gas.
- The electric industry requires no input from coal, \$0.10 from gasoline, \$0.20 from itself, and \$0.30 from natural gas.
- The natural gas industry requires \$0.20 from coal, \$0.10 from gasoline, no input from electric, and \$0.10 from natural gas.

Suppose further that the total production capacity of coal is \$800, of gasoline is \$400, of electric is \$300, and of natural gas is \$1000. Find the external demand.

21. Suppose a closed economy consists of two industries—with x_1 equal to the value of the agriculture output, and x_2 equal to the value of the manufacturing output—and has the following input-output matrix.

$$A = \begin{array}{c} \begin{matrix} \text{A} & \text{M} \end{matrix} \\ \begin{bmatrix} 0.2 & 0.3 \\ 0.8 & 0.7 \end{bmatrix} \end{array} \begin{array}{l} \\ \text{Agriculture} \\ \text{Manufacturing} \end{array}$$

a. Find the productions (outputs of agriculture and manufacturing) for each industry x_1 and x_2.

b. For every \$8 produced by the manufacturing industry, how many dollars' worth of production is needed from the agricultural industry?

22. Suppose a closed economy consists of two industries—with x_1 equal to the value of the energy output, and x_2 equal to the value of the real estate output—and has the following input-output matrix.

$$A = \begin{array}{c} \begin{matrix} \text{E} & \text{R} \end{matrix} \\ \begin{bmatrix} 0.4 & 0.2 \\ 0.6 & 0.8 \end{bmatrix} \end{array} \begin{array}{l} \\ \text{Energy} \\ \text{Real Estate} \end{array}$$

a. Find the productions (outputs of energy and real estate) for each industry x_1 and x_2.
b. For every \$3 produced by the real estate industry, how many dollars' worth of production is needed from the energy industry?

23. Suppose a closed economy consists of three industries—with x_1 equal to the value of the agriculture output, x_2 equal to the value of the manufacturing output, and x_3 equal to the value of the energy output—and has the following input-output matrix.

$$A = \begin{array}{c} \begin{matrix} \text{A} & \text{M} & \text{E} \end{matrix} \\ \begin{bmatrix} 0.3 & 0.1 & 0.3 \\ 0.5 & 0.4 & 0.4 \\ 0.2 & 0.5 & 0.3 \end{bmatrix} \end{array} \begin{array}{l} \\ \text{Agriculture} \\ \text{Manufacturing} \\ \text{Energy} \end{array}$$

a. Find the productions (outputs of agriculture, manufacturing, and energy) for each industry x_1, x_2, and x_3.
b. For every \$33 produced by the energy industry, how many dollars' worth of production is needed from the agricultural industry and how much is needed from the manufacturing industry?

WRITING & THINKING

24. Use the given input-output matrix to answer the questions that follow.

$$\begin{array}{c} \begin{matrix} \text{C} & \text{G} & \text{E} & \text{N} \end{matrix} \\ \begin{bmatrix} 0.3 & 0.2 & 0.1 & 0.2 \\ 0.2 & 0.1 & 0.1 & 0.1 \\ 0.1 & 0.1 & 0.2 & 0.1 \\ 0.2 & 0.1 & 0.4 & 0 \end{bmatrix} \end{array} \begin{array}{l} \\ \text{Coal} \\ \text{Gasoline} \\ \text{Electric} \\ \text{Natural Gas} \end{array}$$

a. Which industry is most dependent on its own production for its operation?
b. Which industry is least dependent on its own production?
c. Which industry is most dependent on the natural gas industry?
d. Which industry would be most affected by a rise in the cost of coal?