

Show all work

1. From past records it is found that when it rains one day, the probability of rain for the next day is 0.32. When it does not rain one day, the probability of rain the next day is 0.08.
 - a) (6 pts) Draw a transition diagram for this situation, using R for rain.
 - b) (6 pts) Write the transition matrix, P.
 - c) (8 pts) If it doesn't rain today, what is the probability of it raining 2 days from now?

2. (9 pts) In a random sample of 200 women who suspect they are pregnant, 150 turn out to be pregnant. A pregnancy test given to these women indicated pregnancy in 135 of the 150 pregnant women and in 6 of the 50 nonpregnant women. If a woman who suspects she is pregnant has a test indicating she is pregnant, what is the probability that she actually is pregnant? Round your answer to 3 significant digits.

3. (9 pts) Use Gauss-Jordan elimination to solve the system of equations:
$$\begin{aligned}x_1 + 3x_2 - 2x_3 &= 6 \\2x_1 - x_2 + 3x_3 &= -2 \\x_1 + 10x_2 - 9x_3 &= 20\end{aligned}$$

4. (9 pts) An economy is based on two industrial sectors, agriculture and fabrication. Production of a dollar's worth of agriculture requires an input of \$0.30 from the agriculture sector and \$0.10 from the fabrication sector. Production of a dollar's worth of fabrication requires an input of \$0.60 from the agriculture sector and \$0.20 from the fabrication sector. Find the output for each sector that is needed to satisfy a final demand of \$40 billion for agriculture and \$25 billion for fabrication.

5. (8 pts) If $A = \begin{pmatrix} 1 & 2 & 1 \\ 1 & 2 & -1 \\ 3 & 1 & -1 \end{pmatrix}$, then $A^{-1} = \begin{pmatrix} 0.1 & -0.3 & 0.4 \\ 0.2 & 0.4 & -0.2 \\ 0.5 & -0.5 & 0 \end{pmatrix}$

Use this result to solve the system of equations:

$$\begin{aligned} x_1 + 2x_2 + x_3 &= 1 \\ x_1 + 2x_2 - x_3 &= 5 \\ 3x_1 + x_2 - x_3 &= 11 \end{aligned}$$

6. (8 pts) How much should be initially deposited in an account paying 11.6% interest compounded quarterly in order to have \$10,000 after 8 years? Round your answer to the nearest dollar.
7. (9 pts) Rob bought a car for \$2500 down and \$250 a month for 36 months. If interest is 13.2% compounded monthly, what was the selling price of the car? How much total interest did Rob pay?
8. (9 pts) An ordinary annuity pays 8.4% compounded monthly. Rob decides to deposit \$200 monthly for the next 25 years and then make equal monthly withdrawals for the next 20 years. How much will Rob withdraw each month?
9. (9 pts) Use matrix methods to solve:

$$\begin{aligned} \text{Minimize } C &= 10x_1 + 40x_2 \\ \text{Subject to } x_1 + 4x_2 &= 4 \\ x_1 + 2x_2 &= 5 \\ -x_1 + 3x_2 &= -1 \\ x_1, x_2 &\geq 0 \end{aligned}$$

10. (9 pts) Use matrix methods to solve:

$$\begin{aligned} \text{Maximize } P &= 4x_1 + 2x_2 + x_3 \\ \text{Subject to } x_1 + 2x_2 + 3x_3 &= 6 \\ x_1 + x_2 + x_3 &= 4 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

11. (9 pts) Rob is making two drink mixes: Mix I and Mix II.

Each case of Mix I needs 1 gal of Drink A, 2 gal of Drink B, and 1 gal of Drink C.

Each case of Mix II needs 1 gal of Drink A, 1 gal of Drink B, and 2 gal of Drink C.

Mix I has a profit of \$15 per case, while Mix II has a profit of \$20 per case.

If Rob has 6 gal of Drink A, 11 gal of Drink B, and 10 gal of Drink C available, how many cases of each mix should he make to maximize his profits?