National University

of Computer & Emerging Sciences Peshawar Campus

Program: BS (CS)
Semester: Fall-2019
Course: MT104-Linear Algebra
Instructor Name: Mr. Osama Sohrab

Examination: Assignment # 01
Total Marks: 10, Weightage: **02**
Date of Submission: 19 / 09 / 2019
Batch : 18

Note: Attempt all questions.

Q1. Determine the polynomial $p(x) = a_0 + a_1x + a_2x^2$ whose graph passes through the points (1, 4), (2, 0), and (3, 12).

Q2. Find a polynomial that fits the points

$$(-2, 3), (-1, 5), (0, 1), (1, 4), \text{ and } (2, 10).$$

Q3. Set up a system of linear equations to represent the network shown in Figure 1.6. Then solve the system.

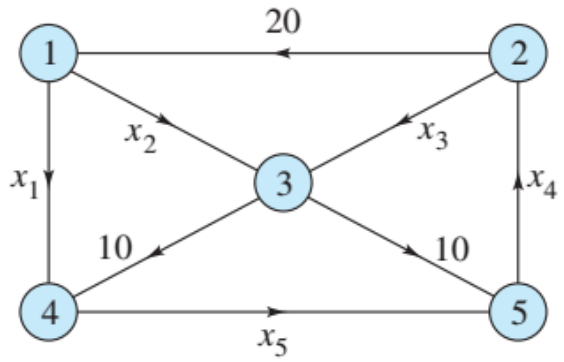
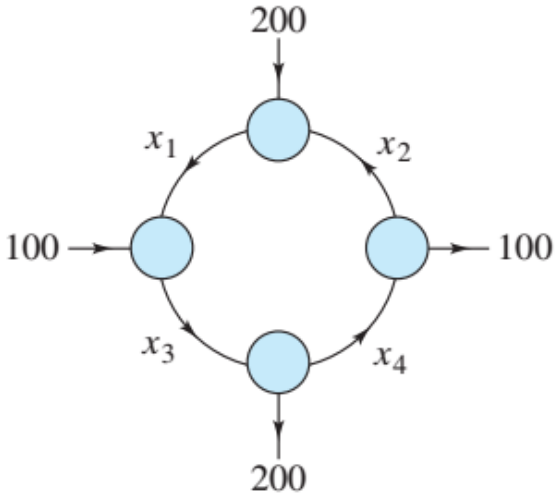


Figure 1.6

Q4.

Network Analysis The figure shows the flow of traffic (in vehicles per hour) through a network of streets.



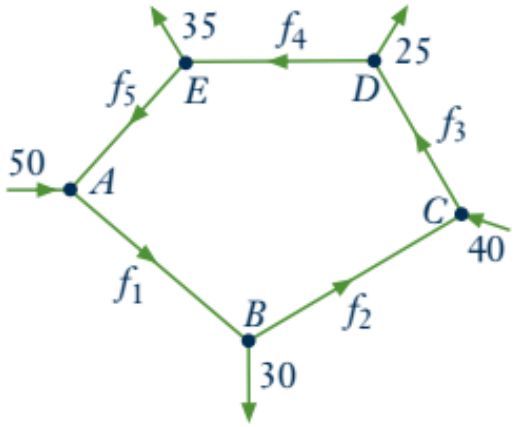
(a) Solve this system for x_i, $i = 1, 2, 3, 4$.

(b) Find the traffic flow when $x_4 = 0$.

(c) Find the traffic flow when $x_4 = 100$.

(d) Find the traffic flow when $x_1 = 2x_2$.

Q5. A traffic circle has five one-way streets, and vehicles enter and leave as shown in the accompanying diagram.



(a) Compute the possible flows.

(b) Which road has the heaviest flow?

Q6. Find a, b, and c so that the system

$$\begin{aligned} x + ay + cz &= 0 \\ bx + cy - 3z &= 1 \\ ax + 2y + bz &= 5 \end{aligned}$$

has the solution $x = 3, y = -1, z = 2$.

Q7.

In each case find (if possible) conditions on a, b, and c such that the system has zero, one, or infinitely many solutions.

(a) $$\begin{aligned} x + 2y - 4z &= 4 \\ 3x - y + 13z &= 2 \\ 4x + y + a^2z &= a + 3 \end{aligned}$$

◆(b)
$$\begin{aligned} x + y + 3z &= a \\ ax + y + 5z &= 4 \\ x + ay + 4z &= a \end{aligned}$$

Q8. A man is ordered by his doctor to take 5 units of vitamin A, 13 units of vitamin B, and 23 units of vitamin C each day. Three brands of vitamin pills are available, and the number of units of each vitamin per pill are shown in the accompanying table.

	Vitamin		
Brand	**A**	**B**	**C**
1	1	2	4
2	1	1	3
3	0	1	1

(a) Find all combinations of pills that provide exactly the required amount of vitamins (no partial pills allowed).

Q9. Three Nissans, two Fords, and four Chevrolets can be rented for \$106 per day. At the same rates two Nissans, four Fords, and three Chevrolets cost \$107 per day, whereas four Nissans, three Fords, and two Chevrolets cost \$102 per day. Find the rental rates for all three kinds of cars.

Q10. In each of the following, find all values of a for which the system has nontrivial solutions, and determine all solutions in each case.

(a)
$$\begin{aligned} x - 2y + z &= 0 \\ x + ay - 3z &= 0 \\ -x + 6y - 5z &= 0 \end{aligned}$$

◆(b)
$$\begin{aligned} x + 2y + z &= 0 \\ x + 3y + 6z &= 0 \\ 2x + 3y + az &= 0 \end{aligned}$$

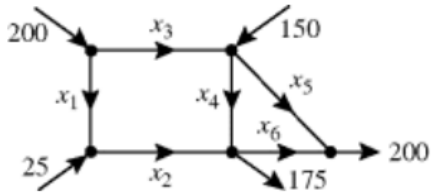
Q11.

The accompanying figure shows known flow rates of hydrocarbons into and out of a network of pipes at an oil refinery.

(a) Set up a linear system whose solution provides the unknown flow rates.

(b) Solve the system for the unknown flow rates.

(c) Find the flow rates and directions of flow if $x_4 = 50$ and $x_6 = 0$.



Q12 Solve the following system of equations for x and y.

$$\begin{aligned} x^2 + xy - y^2 &= 1 \\ 2x^2 - xy + 3y^2 &= 13 \\ x^2 + 3xy + 2y^2 &= 0 \end{aligned}$$

[*Hint*: These equations are linear in the new variables $x_1 = x^2$, $x_2 = xy$, and $x_3 = y^2$.]

The END