

1. Convert the following expressions into prefix notation.

$$(x+3)*(a+b+7*y)$$

$$a*b+c*d$$

$$3*a+b+c*(d+e)$$

2. Define the following terms

- a. Graph
- b. Vertex
- c. Edge
- d. Adjacent
- e. Path
- f. Connected
- g. Directed graph
- h. Strongly connected
- i. Connected Component
- j. Degree
- k. In-degree and out-degree
- l. Cycle
- m. Simple Path, Simple cycle
- n. bipartite graph
- o. Complete graph
- p. Source and sink
- q. Tree
- r. Spanning tree

3. Prove that:

$$\sum_{i=1}^n (4i - 7) = 2n^2 - 5n$$

4. Prove that:

$$\sum_{i=1}^n (i^2 + i + 1) = \frac{n^3 + 3n^2 + 5n}{3}$$

5. Prove that:

$$n^3 > 2n^2 + 1 \text{ whenever } n > 2$$

6. Multiply the following

$$\begin{pmatrix} 1 & 2 & 1 & 3 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \\ 1 \\ 2 \end{pmatrix}$$

7. Multiply the following:

$$\begin{pmatrix} 2 \\ 1 \\ 1 \\ 2 \end{pmatrix} \begin{pmatrix} 1 & 2 & 1 & 3 \end{pmatrix}$$

8. Multiply the following:

$$\begin{pmatrix} 1 & 3 & 1 \\ 2 & 2 & 1 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 2 & 1 \\ 3 & 2 \end{pmatrix}$$

9. Multiply the following:

$$\begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 1 & 2 & 1 \end{pmatrix} \begin{pmatrix} 3 & 3 & 1 \\ 2 & 1 & 1 \\ 3 & 1 & 2 \end{pmatrix}$$

10. Combine the following permutations as indicated:

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 1 & 2 & 4 \end{pmatrix} \circ \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \end{pmatrix}$$

11. Combine the following:

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 3 & 2 & 1 \end{pmatrix} \circ \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 1 & 2 & 3 \end{pmatrix}$$

12. Combine the following:

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 1 & 4 & 2 \end{pmatrix} \circ \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 3 & 4 \end{pmatrix}$$

13. Combine the following:

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 1 & 3 & 2 \end{pmatrix} \circ \begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{pmatrix}$$

14. Give addition and multiplication tables for Modulo 3 arithmetic.

15. Give addition and multiplication tables for Modulo 4 arithmetic.

16. Give addition and multiplication tables for Modulo 5 arithmetic.

17. Does the inverse law hold for Modulo 6 arithmetic? Modulo 7? Modulo 9?

18. Prove the following identity $(A \cap B) \cup C = (A \cap B) \cap (B \cup C)$.

19. Prove the following rule algebraically: $(x - 2)^2 = x^2 - 4x + 4$.

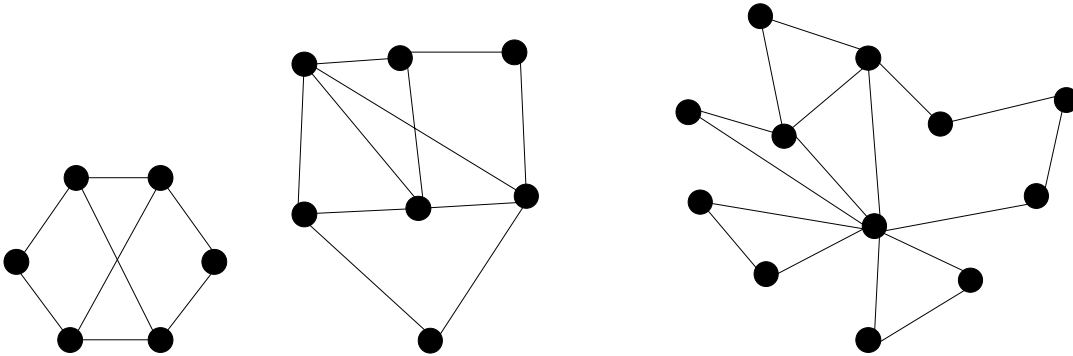
20. Prove the following identity $A' \cup (B \cap C') = ((A \cap B') \cup (A \cap C))'$.

21. Prove the following algebraically $(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$.

22. Find Boolean Expressions for the following functions.

ABCD	f	g	h	k
TTTT	T	T	F	F
TTTF	T	T	F	F
TTFT	T	T	F	F
TTFF	F	T	F	T
TFTT	F	F	T	T
TFTF	F	F	F	T
TFFT	F	F	F	F
TFFF	T	T	F	T
FTTT	T	F	T	T
FTTF	T	F	F	T
FTFT	F	F	F	F
FTFF	T	F	F	F
FFTT	F	T	T	F
FFTF	T	T	T	F
FFFT	T	T	T	T
FFFF	F	F	T	T

23. Do the following graphs have Euler paths or Euler cycles or neither?



24. Give the adjacency list for the following graph.

