

1. Prove that:

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

2. Prove that:

$$\sum_{i=0}^n 3^i = \frac{3^{n+1} - 1}{2}$$

3. Prove that:

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

4. Multiply the following

$$(1 \ 2 \ 1 \ 3) \begin{pmatrix} 2 \\ 1 \\ 1 \\ 2 \end{pmatrix}$$

5. Multiply the following:

$$\begin{pmatrix} 2 \\ 1 \\ 1 \\ 2 \end{pmatrix} (1 \ 2 \ 1 \ 3)$$

6. Multiply the following:

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

7. Multiply the following:

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

8. How many permutations are there on a set of 3 elements? 4? 5? 6?

9. Combine the following permutations as indicated:

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

10. Combine the following:

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

11. Combine the following:

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

12. Combine the following:

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

13. What is a function?

What is an onto function?

What is a one-to-one function?

14. What does it mean to say that a function is recursive?

15. How fast are the following algorithms?

BubbleSort, Quicksort, Mergesort.

16. Convert from binary to decimal:

1011011. 1010. 111011101110. 10101011101110.

17. Convert from decimal to binary:

43, 6006, 2040, 1010, 2048.

18. Convert from Hexadecimal to binary

1A3F FF 401 AA55 1011

19. Convert from binary into hexadecimal.

11101011101001 1001011101110 101010011 1000000100001

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

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

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

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