

1. [4 + 4 = 8 points]

Construct the minimum spanning tree (MST) for the given graph shown in Figure 1 using Prim's algorithm. Thus calculate the weight of the MST. Repeat the procedure using a Reverse delete algorithm. Then, again calculate the weight of the MST.

2. [8 points] Using Karatsuba integer multiplication algorithm, compute the product of 2341 and 3412 using step-by-step algorithmic approach.

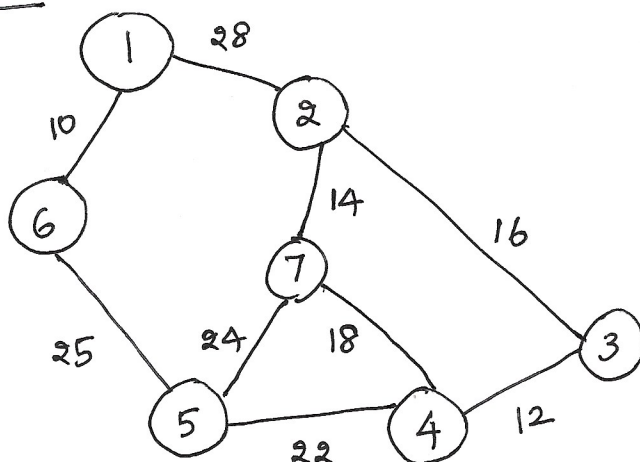
3. [8 points] Using convolution approach with all the necessary steps (using Lagrange's method of computing each term in the resultant polynomial), compute the product of 12 and 45.

4. [8 points] Use the block matrix multiplication approach to multiply the following two matrices. You need to use the algorithm provided for matrix multiplication which you learnt in your class.

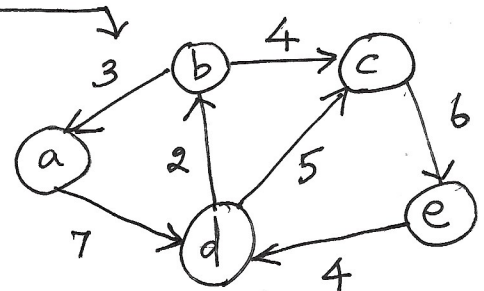
$$A = \begin{bmatrix} 0 & 1 & 2 & 3 \\ 1 & 2 & -1 & 2 \\ 3 & -1 & 3 & 1 \\ 2 & 1 & 3 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 2 & -3 & -1 & 0 \\ 0 & 3 & 2 & 4 \\ 3 & 2 & 0 & 1 \\ 0 & 3 & 2 & 4 \end{bmatrix}$$

5. [2 + 2 = 4 points] Consider the word (a) ALGORITHMIC, (b) PALINDROME. Using mergesort method of sorting, sort the alphabets in the word. [Hint: You need to split the entire word into smaller words step by step until you reach the leaf node]

6. [4 points] Use the Dijkstra's algorithm to find the shortest path from node a to all other nodes in the following graph: (Figure 2)

Figure 1

(Figure 1)



(Figure 2)