Linear Partition Worksheet

Define M [n, k] to be the minimum possible cost over all partitions of (s1, . . . , sn) into k ranges.

1. Consider the input (100, 200, 300, 400, 500, 600, 700) with k = 3. What is M [7, 3]? (**Hint**: It should be possible to answer this by visual inspection.)

   100 200 300| 500 600 |700

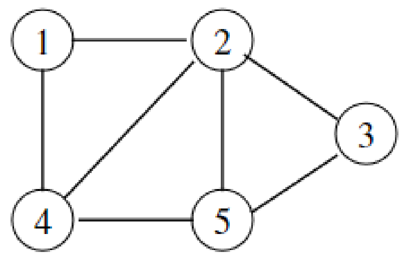
   M[7, 3] = 1,100

2. What are M [1, 2], M [2, 2], M [3, 2], M [4, 2], M [5, 2], M [6, 2], and M [7, 2]? (again, use visual inspection).
   M[1, 2] = 100
   M[2, 2] = 200
   M[3, 2] = 300
   M[4, 2] = 600
   M[5, 2] = 900
   M[6, 2] = 1,100
   M[7, 2] = 1,500

3. Can you write a formula for M [7, 3] in terms of M [1, 2], M [2, 2], M [3, 2], M [4, 2], M [5, 2], M [6, 2], and M [7, 2]?

   $M[n, k] = \min\{\max(M[i, k\text{-}1], \sum_{j=i+1}^{n} s_j)\}$
   M[7, 3] = max(M[6,2], s[7]) = 1,100

Graph Representation Worksheet



1. What are the storage requirements assuming an adjacency matrix is used. Assume each element of the adjacency matrix requires four bytes.

$$\begin{array}{c c} & \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} & \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

$25 \times 4 = 100$ bytes

2. Repeat for an adjacency list representation. Assume that an int requires 4 bytes and that a pointer also requires 4 bytes.

1	☐	➔	2 -> 4
2	☐	➔	1 -> 4 -> 5 -> 3
3	☐	➔	2 -> 5
4	☐	➔	1 -> 2 -> 5
5	☐	➔	4 -> 2 -> 3

$5 \times 4 = 20$ $\quad$ $14 \text{ nodes} \times 8 = 112$ $\quad$ $20 + 112 = 132$

3. Now, consider an undirected graph with 100 vertices and 1000 edges. What are the storage requirements for the adjacent matrix and adjacency list data structures?

AM: $4n^2 \Rightarrow 4 \times 100^2 = 40{,}000$

AL: $4n + 8(2m) = 4n + 16m \Rightarrow 4 \times 100 + 16 \times 1000 = 16{,}400$

Adjacency list is better than adjacency matrices