Homework5 Solution

Question2: Suppose that we would like to perform the following tasks using MapReduce. For each case, please determine the input/output of each mapper and reducer and all intermediate key-value pairs generated in the process of MapReduce.

a) Matrix-to-Vector multiplication using MapReduce with 4 mappers and 2 reducers:

$$\begin{bmatrix} 2 & -3 & 1 & 5 \\ 7 & 2 & -1 & 0 \end{bmatrix} \begin{bmatrix} 3 \\ 5 \\ -6 \\ 9 \end{bmatrix}$$

ANSWER:

As for part(a) of question2, Each mapper can take care of one column of the first matrix (in other word, each mapper takes care of two elements).

The output of mappers and reducers should be in the form of key-value pairs (please see lecture 24):

Mapper: $((i,j),m_{ij})$ & (j,v_j) ==> $(i,m_{ij} \times v_j)$

Thus, we have:

Mapper1: ((1,1),2) & (1,3) --> (1,6) and ((2,1),7) & (1,3) --> (2,21)
Mapper2: ((1,2),-3) & (2,5) --> (1,-15) and ((2,2),2) & (2,5) --> (2,10)
Mapper3: ((1,3),1) & (3,-6) --> (1,-6) and ((2,3),-1) & (3,-6) --> (2,6)
Mapper4: ((1,4),5) & (4,9) --> (1,45) and ((2,4),0) & (4,9) --> (2,0)

Reducer1: (1,[6,-15,-6,45]) --> (1, 6-15-6+45)= (1, 30)
Reducer2: (2,[21,10,6,0]) --> (2, 21+10+6+0)=(1, 37)