is empty. Any claim on an empty set is vacuously true. ∴ Loop invariant holds ☑.

Maintenance: Let, the loop invariant hold just before the start of the iteration when $i=x$, where $1 \leq x \leq numCols$. ∴ $\forall K, 0 \leq K < x$, rowTerms[K]=0. Line 9 implies rowTerms[x]=0. Before the start of the next iteration, i updates to (x+1) and it's easy to see that the loop invariant still holds.

Termination: The loop terminates when i=numCols. By the loop invariant, $\forall K, 0 \leq K \leq numCols-1$, rowTerms[K]=0. We know, by line 4 numCols=a[0].col

∴ For each column of a[ ], the array holding the respective no. of non-zero elements has been initially initialized to 0.

□

Loop invariant of lines 10-11: Just before the start of the ith iteration of the loop, for all indices K where $1 \leq K < i$, the no. of elements corresponding to each column j where $0 \leq j < a[0].col$ has been correctly computed and stored in rowTerms[j] for all the terms a[K].value. → bit vague

Suggested Refinement (ChatGPT): At the beginning of the ith iteration (where $1 \leq i < numTerms$), for every column index j in the range $0 \leq j < a[0].col$, the value rowTerms[j] is equal to the number of times a[K].col==j for all K such that $1 \leq K < i$.

Initialization: At the start of the 1st iteration of the loop, i=1. Just before the start of this iteration, the term indices of a[] $1 \leq K <$ i=1 is empty. Any claim on an empty set is vacuously true.