9101 Assignment 1
Haojin Guo
z5216214

Question 3

Step(i): Sort the array A, using Merge Sort, which costs $O(nlogn)$. And then an ordered and possibly duplicate array A is obtained.

Step(ii):
Iterating each pair of integers (L_i, U_i), which costs $O(n)$;
For every L_i, do binary search in sorted array A, and find the index_1 corresponding to L_i $(O(logn))$;
For every U_i, do binary search in sorted array A, and find the index_2 corresponding to $(O(logn))$ U_i;
Then by subtracting between index_2 and index_1, we can get the number of elements of A which satisfy $L_i \leq A[m] \leq U_i$.
The cost of this step is, $O(n) * O(2logn) = O(nlogn)$.

Therefore, the total time complexity is, $O(nlogn) + O(nlogn) = O(nlogn)$