1.   $C = [0, 0, 0, 0]$

   $A = [0, 2, 0, 1, 3, 1, 1]$

first $\Rightarrow$ $C = [2, 3, 1, 1]$

secont $\Rightarrow$ $C = [2, 5, 6, 7]$

third :

   $B[\ ,\ ,\ ,\ ,1,\ ,\ ]$

   $c[2, 4, 6, 7]$

   $B[\ ,\ ,\ ,1,1,\ ,\ ]$

   $C[2, 3, 6, 7]$

   $B[\ ,\ ,\ ,1,1,\ ,3]$

   $c[2, 3, 6, 6]$

   $B[\ ,\ ,1,1,1,\ ,3]$

   $c[2, 2, 6, 6]$

   $B[\ ,0,1,1,1,\ ,3]$

   $C[1, 2, 6, 6]$

   $B[\ ,0,1,1,1,2,3]$

   $c[1, 2, 5, 6]$

   $B[0,0,1,1,1,2,3]$

   $c[0, 2, 5, 6]$.

2. Because after the first loop in line 4-5, $C[i]$ is the count of occurences of the element in the array $A$. Then the for loop in line 6-7 iterates from 1 to $k$., let $C[i]$ be the cumulative sum $C[i] = \sum_{k=0}^{i} C[k]$. Thus $C[i]$ represents the count of element that less or equal to $i$.

3. ③ will not be stable but will sort the numbers

The changed algorithm will still count and place all elements correctly according to their sorted order in $B$. Thus, the algorithm will still sort the numbers.

But when we process the placement forward, the same elements appear earlier in $A$ will be placed before the later one. Then it will be placed after the later one, it changed the order of the same element. So it is not stable.

4.
```
let C[0...k] be a new array
for i=0 to k do
    c[i] = 0
for j=1 to A.length do
    C[A[j]] += 1
for i=1 to k do
    c[i] += c[i-1] .
if a=0
    return c[b] .
if a>0
    return c[b] - c[a-1] .
```

5. ① sort by the 3rd letter
MOB, TAB, DOG, TUG, PIG, BIG, BAR, CAR, TAR, COW, ROW, WOW, BOX
② sort by the 2nd letter,
TAB, BAR, CAR, TAR, PIG, BIG, MOB, DOG, COW, ROW, WOW, BOX, TUG
③ sort by the 1st letter
BAR, BIG, BOX, CAR, COW, DOG, MOB, PIG, ROW, TAB, TAR, TUG, WOW.

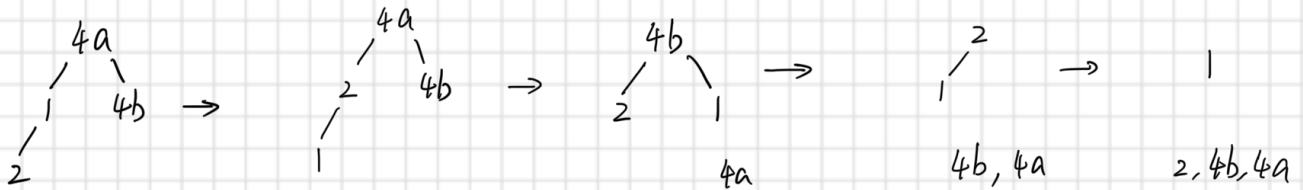b. ① Insertion Sort : Stable

Because when a unsorted element enter the sorted part, it won't swap with the element as same as it.

② Merge Sort : Stable.

Because in the merge step, it preserve the order of the same element by choosesing elements from the left subarray before right.

③ Heap Sort : Not stable.

[4a, 1, 4b, 2].



⇒ 1, 2, 4b, 4a .

④ · Quick Sort : Not Stable.

[4a, 1, 4b, 2]

| 4a | 1 | 4b | 2 |

| 1 | 4a | 4b | 2 |

| 1 | 2 | 4b | 4a |