

CSE 310 Recitation 5

Objectives:

1. Exercise on counting sort

Instruction

1. For all recitation exercise, we highly recommend that you submit a typed solution with the original questions inside; in case you don't have enough time to do so, a hand-written one is acceptable only when: the solution is clearly written and must be saved in .pdf format. Note: unreadable answer receives no credits!
2. All recitation exercises must be submitted through the link posted on Canvas, we do NOT accept any submissions through emails!

Question

1. [8 pts] Illustrate the operation of COUNTING-SORT(A, B, k) on array $A = \{6, 0, 2, 0, 1, 3, 4, 6, 1, 3, 2\}$. Note: you need to clearly mark/write array B and counter array C's contents in each step.

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 2 | 2 | 2 | 1 | 0 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 4 | 6 | 8 | 9 | 9 | 11 |

Index = 11

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 4 | 5 | 8 | 9 | 9 | 11 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | | | 2 | | | | | |

Index = 10

A

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|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 4 | 5 | 7 | 9 | 9 | 11 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | | | 2 | | 3 | | | |

Index = 9

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 3 | 5 | 7 | 9 | 9 | 11 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | 1 | | 2 | | 3 | | | |

Index = 8

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 3 | 5 | 7 | 9 | 9 | 10 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | 1 | | 2 | | 3 | | | 6 |

Index = 7

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 3 | 5 | 7 | 8 | 9 | 10 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | 1 | | 2 | | 3 | 4 | | 6 |

Index = 6

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 3 | 5 | 6 | 8 | 9 | 10 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | 1 | | 2 | 3 | 3 | 4 | | 6 |

Index = 5

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | 2 | 5 | 6 | 8 | 9 | 10 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | 1 | 1 | | 2 | 3 | 3 | 4 | | 6 |

Index = 4

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 2 | 5 | 6 | 8 | 9 | 10 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | 0 | 1 | 1 | | 2 | 3 | 3 | 4 | | 6 |

Index = 3

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 2 | 4 | 6 | 8 | 9 | 10 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | | 6 |

Index = 2

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 0 | 2 | 4 | 6 | 8 | 9 | 10 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 0 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | | 6 |

Index = 1

A

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 0 | 2 | 0 | 1 | 3 | 4 | 6 | 1 | 3 | 2 |

C

| | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 0 | 2 | 4 | 6 | 8 | 9 | 9 |

B

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 0 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 6 | 6 |

2. Is counting sort stable or not? **Yes**
3. As above shows, we place the element in decreasing order of the index, thus we have for $j = A.length$ down to 1 inside the algorithm. If we change it to for $j = 1$ to $A.length$, whether the algorithm still works properly or not? **No**