

08 A: Sorting IV

CS1102S: Data Structures and Algorithms

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- 1 Bucket Sort
- 2 Puzzlers

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 - Recall: A Counter-Example
 - Bucket Sort
- 2 Puzzlers

Counter-example: Sorting Small Distinct Integers

Input

Array a of N distinct integers from 1 to M

Sorting algorithm

```
int [] helper = new int [M];
for (int i=0; i<N; i++)
    helper[a[i]] = a[i];
int index = 0;
for (int j=0; j<M; j++)
    if (helper[j]!=0)
        a[index++] = helper[j];
```

Counter-example: Sorting Small Distinct Integers

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Analysis

Runtime $O(M + N)$

A Couple of Ideas

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- We do not have to store the element in the array; boolean values will do
- How can we drop the condition “distinct integers”?
- Instead of boolean values in the array helper, we count the number of occurrences of a given integer

Bucket Sort

```
int [] helper = new int [M];
for (int i=0; i<N; i++)
    helper[a[i]]++;
int index = 0;
for (int j=0; j<M; j++)
    while (helper[j]-- != 0)
        a[index++] = j;
```

Bucket Sort

```
int[] helper = new int[M];
for (int i=0; i<N; i++)
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int index = 0;
for (int j=0; j<M; j++)
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Analysis

Runtime $O(M + N)$

1 Bucket Sort

2 Puzzlers

- Previous Puzzler: The Last Laugh
- This Week's Puzzler: Printing Money

1 Bucket Sort

2 Puzzlers

- Previous Puzzler: The Last Laugh
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Previous Puzzler: The Last Laugh

What does the following program print?

```
public class LastLaugh {  
    public static void main(String[] args) {  
        System.out.println("H" + "a");  
        System.out.println('H' + 'a');  
    }  
}
```

Previous Puzzler: The Last Laugh

What does the following program print?

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public class LastLaugh {  
    public static void main(String[] args) {  
        System.out.println("H" + "a");  
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    }  
}
```

This program prints:

Ha

169

Why?

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- What if I want to use characters as strings?
Write: `"" + 'H' + 'a'`

Why?

- Characters in Java are 16-bit numbers.
- Therefore, 'H' + 'a' performs addition of the corresponding character codes as integers: $72 + 97 = 169$.
- What if I want to use characters as strings?
Write: `"" + 'H' + 'a'`
- What does this code print:
`System.out.println("2 + 2 = " + 2+2);`

Summary

Special treatment of +

The + operator performs string concatenation if and only if at least one of its operands is of type String.

New Puzzler: Printing Money

```
class Money {}
class Dollar extends Money {}
class MoneyPrinter {
    public void print(Money x) {
        System.out.println("Money!");
    }
}
class DollarPrinter extends MoneyPrinter {
    public void print(Dollar x) {
        System.out.println("Dollar!");
    }
}
```

New Puzzler: Printing Money

```
Dollar d = new Dollar ();
```

```
MoneyPrinter p = new DollarPrinter ();  
p.print (d);
```