13. Sorting
ENEE 140

Prof. Tudor Dumitraș
Associate Professor, ECE
University of Maryland, College Park

http://ter.ps/enee140

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Today's Lecture

- Where we've been
  - Scalar data types (`int, long, float, double, char`)
  - Vector data types (arrays and strings)
  - Multidimensional arrays
  - Control flow
  - Functions
  - Random number generation
  - File I/O
- Where we're going today
  - Sorting
- Where we're going next
  - Final exam review
  - Final exam: **May 15, 10:30 am – 12:30 pm**

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Incremental Maintenance of Aggregates

- Sometimes, you must compute values that summarize multiple numbers (aggregates)
  - Examples: count, maximum, average
  - You can compute many aggregates incrementally, by updating a variable at each iteration of a loop

```
int a, count = 0, max = INT_MIN;
while (scanf("%d", &a) > 0) {
  count++;
  
}
```

must initialize the aggregates

increment count

update max

- **How should you initialize the aggregate?**

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Swapping Two Variables

- How to swap the values of two variables a and b?
  - a must take the old value of b
  - b must take the old value of a

```
int a=1, b=2;
a=b;
b=a;
```

a is 2

b is 2 **incorrect!**

```
int a=1, b=2, tmp;
tmp = a;
a = b;
b = tmp;
```

tmp is 1

a is 2

b is 1

- **How would you swap 2 rows of a matrix? Or 2 matrices?**

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Sorting

- Rearrange the elements of array `a[N]` so that they are ordered
  - Ascending order: a[0] ≤ a[1] ≤ a[2] ≤ … ≤ a[N-1]
  - Descending order: a[0] ≥ a[1] ≥ a[2] ≥ … ≥ a[N-1]
- There are many sorting algorithms
  - Some use techniques not covered in ENEE 140 (e.g. recursion)
- We focus on a few simple algorithms
  - Selection sort
  - Insertion sort

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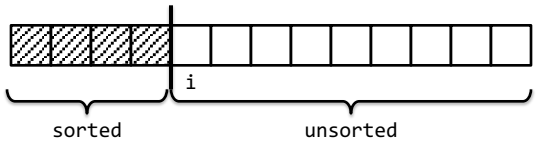
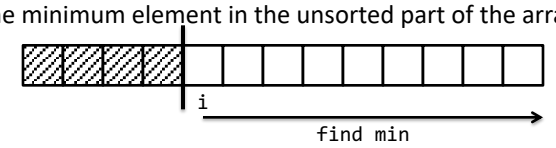
Selection Sort

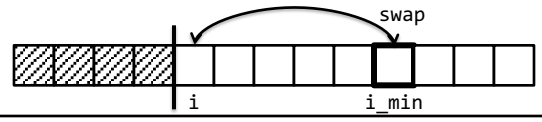
- Key idea: gradually build up the sorted array
- At each iteration:
  - The beginning part of the array contains the lowest elements, in sorted order



  - Find the minimum element in the unsorted part of the array



  - Add it to the end of the sorted part



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Demonstration

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Review of Lecture

- What did we learn?
  - Swapping two variables
  - Selection sort
- Assignments for this week
  - No weekly challenge
  - Homework: `lab12.pdf` (on http://ter.ps/enee140), due on Friday at 11:59 pm

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