

C and analysis units

- ▶ (C) Introduction to C (last week Monday)
- ▶ (C) C functions and the compilation process (last week Wednesday)
- ▶ (Analysis) Loop invariants (last week Friday)
- ▶ (Analysis) Algorithms line-by-line (Wednesday)
- ▶ (Analysis) Review of recursion (**Today**)
- ▶ (Analysis) Analyzing recursive sorting algorithms (next week Monday)
- ▶ (C) Structs (next week Wednesday)

Today and next time:

- ▶ Solution to bubble sort invariants
- ▶ Lab retrospective (merge sort and experiments)
- ▶ Introducing quick sort
- ▶ Binary search, plus analysis
- ▶ Merge sort analysis
- ▶ Quick sort analysis
- ▶ The significance of big-oh
- ▶ Counting sort

Coming up:

- ▶ **Due Wed, Jan 28 (at class time).** *Do the practice problems on the handout and read McDowell Sections 5.(1 & 2)*
- ▶ **Due Thurs, Jan 29, before lab.** *Read “Prelab reading 3” and take quiz on Canvas. **Coming soon...***
- ▶ **Due Mon, Feb 2.** *Do Project 1, “Quick sort and experimental comparisons.”*

```
void bubbleSort(int array[], int n)
{
    int i, j;

    for (i = n; i > 1; i--)
    {
        for (j = 1; j < i; j++)
        {
            if (array[j] < array[j-1])
            {
                int temp = array[j];
                array[j] = array[j-1];
                array[j-1] = temp;
            }
        }
    }
}
```

	10	25	50	75	100	1000	10000	100000
$\lg n$								
$n \lg n$								
n^2								
n^3								
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$								
n^2								
n^3								
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$	23 ms	80 ms	.2 s	.32 s	.46 s	6.9 s	1.5 min	19 min
n^2								
n^3								
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$	23 ms	80 ms	.2 s	.32 s	.46 s	6.9 s	1.5 min	19 min
n^2	.1 s	.625 s	2.5 s					
n^3								
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$	23 ms	80 ms	.2 s	.32 s	.46 s	6.9 s	1.5 min	19 min
n^2	.1 s	.625 s	2.5 s	5.6s				
n^3								
n^{10}								
2^n								

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n^2	.1 s	.625 s	2.5 s	5.6s	10 s			
n^3								
n^{10}								
2^n								

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$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$	23 ms	80 ms	.2 s	.32 s	.46 s	6.9 s	1.5 min	19 min
n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min		
n^3								
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$	23 ms	80 ms	.2 s	.32 s	.46 s	6.9 s	1.5 min	19 min
n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	
n^3								
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$	23 ms	80 ms	.2 s	.32 s	.46 s	6.9 s	1.5 min	19 min
n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3								
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s							
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s						
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s	2 min					
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s	2 min	7 min				
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
$n \lg n$	23 ms	80 ms	.2 s	.32 s	.46 s	6.9 s	1.5 min	19 min
n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s	2 min	7 min	16.7 min			
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
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n^{10}								
2^n								

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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s	2 min	7 min	16.7 min	11.5 days	31 years	
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s	2 min	7 min	16.7 min	11.5 days	31 years	317 cen
n^{10}								
2^n								

	10	25	50	75	100	1000	10000	100000
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s	2 min	7 min	16.7 min	11.5 days	31 years	317 cen
n^{10}	115.7 days							
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^2	.1 s	.625 s	2.5 s	5.6s	10 s	16.7 min	27.8 h	16.3 days
n^3	.1 s	15.6 s	2 min	7 min	16.7 min	11.5 days	31 years	317 cen
n^{10}	115.7 days	30.22 cen						
2^n								

	10	25	50	75	100	1000	10000	100000
$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^3	.1 s	15.6 s	2 min	7 min	16.7 min	11.5 days	31 years	317 cen
n^{10}	115.7 days	30.22 cen	3095 mil	1.78×10^5 mil	3.6×10^6 mil			
2^n								

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$\lg n$	2.3 ms	3.2 ms	3.9 ms	4.3 ms	4.6 ms	6.9 ms	9.2 ms	11.5 ms
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n^3	.1 s	15.6 s	2 min	7 min	16.7 min	11.5 days	31 years	317 cen
n^{10}	115.7 days	30.22 cen	3095 mil	1.78×10^5 mil	3.6×10^6 mil			
2^n	1 s	9 h	35 mil	1.2×10^9 mil	4×10^{16} mil			

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