CS61B DISCUSSION 8

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Revisited: Asymptotics

- Big Oh and Big Omega are useful, but might not give us the best information.
- Example: n = O(n). But n = O(n^2), and n = O(2^n) as well! You can give many upper bounds for the same function.
- Better: Use Big Theta. Tighter bound. See Discussion Q1.

Some summations to know

- $1 + 2 + 3 + \ldots + N = N(N+1)/2 = \Theta(N^2)$
- $1 + 2 + 4 + 8 + \ldots + N = 2N - 1 = \Theta(N)$
- You **should** memorize this, as they will come in handy.
- You don't need to know why. Refer back to your Math 1B notes if you're curious.

Amortized Analysis

- Way of showing that, **on average,** what runtime of something is.
- Example: ArrayDeque usually has constant inserts. Every so often, it has to resize, which is in O(n).
- We can show that it **Amortized Cost** (cost in the long run) is always constant. This is what the table Alan showed in lecture was trying to do.

Insert #	0	1	2	3	4	5	6	7	8	9	10	11	12	13
a[i] = cost (write cost)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
resize cost(copy cost)	0	2	4	0	8	0	0	0	16	0	0	0	0	0
total cost	1	3	5	1	9	1	1	1	17	1	1	1	1	1
cumulative cost	1	4	9	10	19	20	21	22	39	40	41	42	43	44

AMORTIZED ANALYSIS: A DIFFERENT APPROACH. (DEMO)