IN.3028 : Algorithmics - Assignment 2

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1 Chapter 1 : Foundation

1.1 Stack & Queue (linked list) (Implementation)

Provided in the src and tests files.

1.2 Evaluation of expressions in reverse polish notation (Implementation)

Provided in the src and tests files. Note the it is necessay to add a "space" between each element when computing the calculator.

1.3 Shunting Yard Algorithm (Implementation)

Provided in the src and tests files.

1.4 Tilde approximations

1. $N + 1 \sim N$
2. $1 + \frac{1}{N} \sim 1$
3. $(1 + \frac{1}{N})(1 + \frac{2}{N}) = 1 + \frac{1}{N} + \frac{2}{N} + \frac{2}{N^2} = 1 + \frac{3}{N} + \frac{2}{N^2} \sim 1 + \frac{3}{N}$
4. $2N^3 + 15N^2 + N \sim 2N^3$
5. $\frac{ln(2N)}{ln(N)} = \frac{ln(2)+ln(N)}{ln(N)} = \frac{ln(2)}{ln(N)} + 1 \sim 1$
6. $\frac{lg(N^2+1)}{lg(N)} \sim \frac{lg(N^2)}{lg(N)} \sim \frac{2lg(N)}{lg(N)} \sim 2$

1.5 Order of growth (code fragments)

1. The outer loop runs $\log N$ times as n is halved in each iteration. The inner loop runs n times, but with each iteration of the outer loop, n is reduced by half. Considering the sum of a geometric series, the total number of iterations is roughly $2N \sim N + \frac{N}{2} + \frac{N}{4} + ... + 1$. Therefore, the order of growth for the running time is $O(N)$.
2. The outer loop runs $\log N$ times as i is doubled in each iteration. The inner loop runs up to i times. The work done by the inner loop is a geometric series: $1 + 2 + 4 + 8 + \ldots + N/2$. The sum of this series is less than $2N$. Thus, the overall order of growth is $O(N)$.

3. The outer loop runs $\log N$ times as i is doubled in each iteration. The inner loop runs N times for each iteration of the outer loop. Thus, the overall order of growth is $N \log N$, so the complexity is $O(N \log N)$.