

ASSIGNMENT 1

Basic Data Structure and Algorithm Analysis

Learning outcome:

1. Understand concept and operation data structure
2. Identify algorithm complexity and efficiency

Dateline: 2 November 2025, upload to PutraBLAST

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1. Rank the growth-rate functions from highest to lowest. Show all your steps.

- i) $n^2 + n \log n + 75$
- ii) $2^n + n^2$
- iii) $n - n^{3/4}$

2. Given the two algorithms below:

Algorithm 1

```
count = 0;
sum=0;

num = Integer.parseInt(keyboard.readLine());

while(count < n) {
    sum = sum + num;
    count++;
    num = Integer.parseInt(keyboard.readLine());
}

if (count !=0)
    average = sum/count;
else
    average = 0;
```

Algorithm 2

```
float sum=0;
int=0;
while (i < n) {
    int j=0;
    while (j < n) {
        sum += a[i];
        j++;
    }
    i++;
}
if (n > 0)
    average= sum/n;
else
    average= 0.0;
```

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- (i) Find the number of operations executed by the algorithm 1 and algorithm 2.
 - (ii) Based on your answer in 2(i), identify the high-order term and indicate the order of each algorithm using Big-O notation.
 - (iii) Which algorithm is the most efficient? Proof your finding
3. Calculate the Big-Oh for each functions:
- a) $f(n) = 3n(2n^2 + n - 1)$
 - b) $f(n) = \left\lceil \frac{n+1}{2} \right\rceil \times \left\lceil \frac{n+1}{2} \right\rceil$
4. N^3 grows faster than N^2 . Does $f(N)=N^2$ and $g(N)=2N^2$ grow at the same rate? Discuss your answer.