

shortest to longest

i.

```

sum = 0;
for (i = 0; i < n; i++) {
    sum++;
}
    
```

$1 + (1+n+1+n) + 1$
 $1 + (1+n+2)+1$
 $2 + 2n + 2$
 $2n + 4 \Rightarrow O(N)$ Linear

ii.

```

sum = 0;
for (i = 0; i < n; i++) {
    for (j = 0; j < n; j++) {
        sum++;
    }
}
    
```

$1 + (2n+1) + (2n+2)n + \dots + (2n)(n)$
 $2n + 3 + 2n^2 + 2n + n^2$
 $3n^2 + 4n + 3 \Rightarrow O(N^2)$ Quadratic

iii.

```

sum = 0;
for (i = 0; i < n; i++) {
    for (j = 0; j < i; j++) {
        sum++;
    }
}
    
```

$1 + (2n+2) + (2n+2)n + 1$
 $2n + 4 + \frac{2n^2 + 2n}{2}$
 $4n + 8 + 2n^2 + 2n$
 $2n^2 + 6n + 8 \Rightarrow O(N^2)$ quadratic

iv.

```

sum = 0;
for (i = 0; i < n * n; i++) {
    for (j = 0; j < n * n; j++) {
        sum++;
    }
}
    
```

$2n + 3 + \frac{(2n+3)n}{2} + 1$
 $2n + \frac{(2n^2 + 3n)}{2} + 4$
 $4n + 2n^2 + 3n + 8$
 $2n^2 + 7n + 8 \Rightarrow O(N^2)$ quadratic

- $O(0)$
- $O(5)$
- $O(2/N)$
- $O(\log N)$
- $O(N)$
- $O(NM)$
- $O(\sqrt{N})$
- $O(N \log N)$
- $O(N^{1.5})$
- $O(N^2)$
- $O(2^N)$
- $O(N^4)$
- $O(\infty)$