Order of Growth

Wednesday, June 28, 2017 5:52 PM

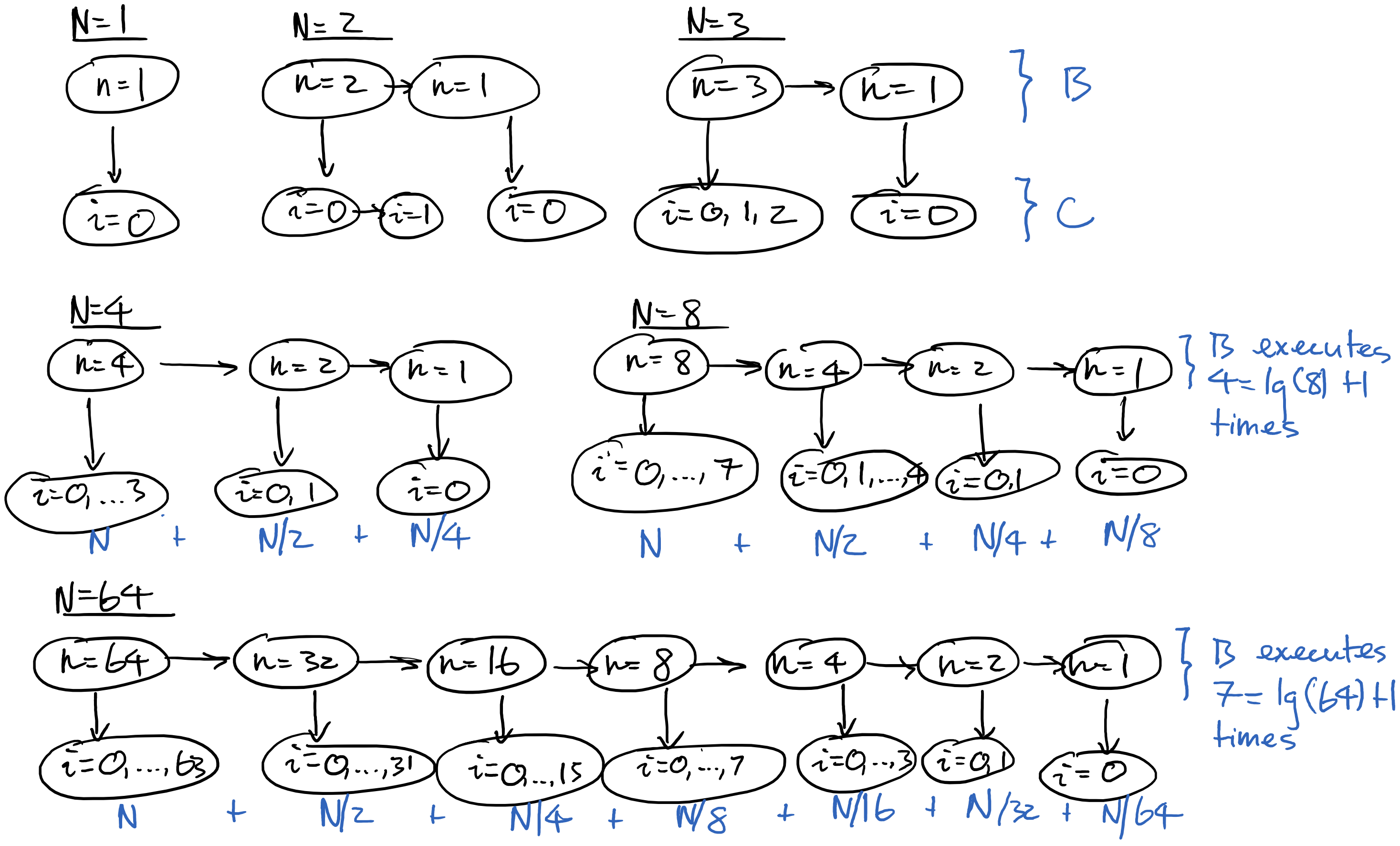
1.4.6. a)

```
int  sum = 0;
for (int n = N;  n>0;  n/=2)
  for (int i=0;  i<n;  i++)
    sum++;
```

A

B lg(N) +1

C N+ N/2+ N/4+...



This code fragment has linear order of growth
N + N/2 + N/4 + N/8 +...

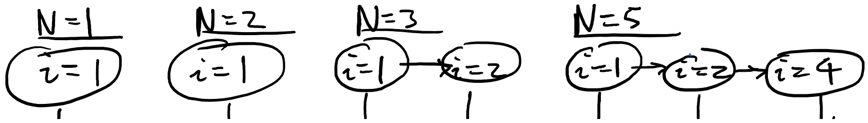
b)

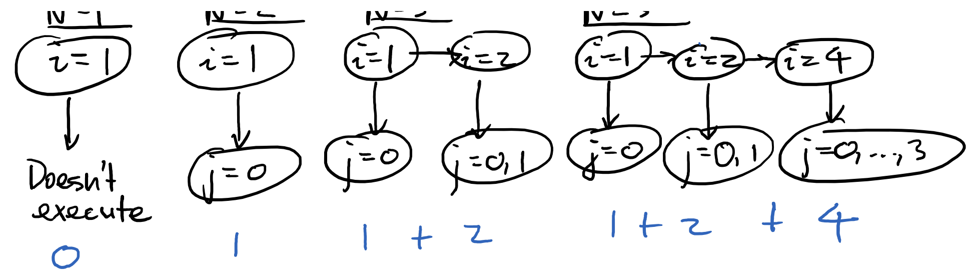
```
int sum = 0;
for (int  i=1;  i< N;  i *=2)
  for (int  j=0;  j<i;  j++)
    sum++;
```

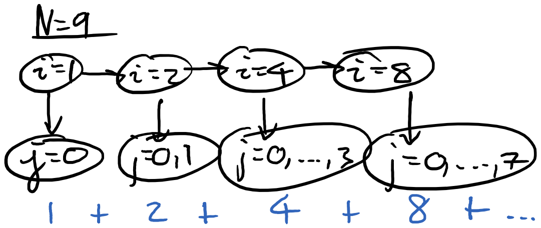
A

B

C

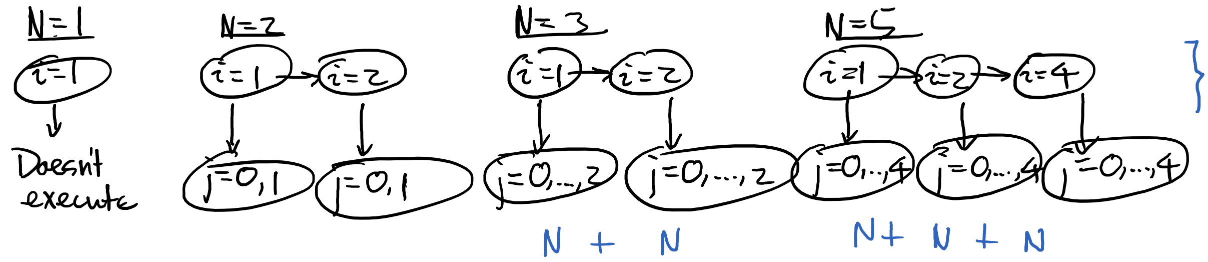




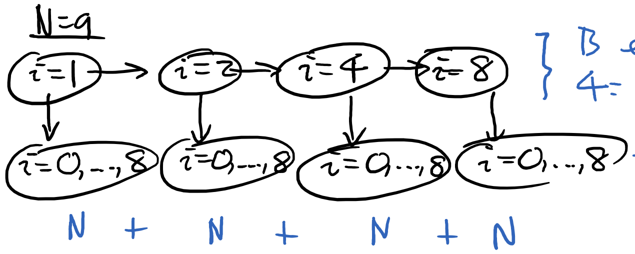


Linear: 1+2+4+8+...

```
c) int sum = 0;
   for (int i = 1;  i < N;  i *= 2)
     for (int j = 0;  j < N;  j++)
       sum++;
```



B executes $3 = \underbrace{\lg(4)}_{2} + 1$ times



B executes $4 = \underbrace{\lg(8)}_{3} + 1 = \lg(N-1) + 1$ times

C executes

$$4N = (\lg(N-1)+1)N$$
$$= \lg(N-1)N + N$$
$$\sim \lg(N) \cdot N \text{ times}$$

Linearithmic: $\lg(N) \cdot N$