Analysis of Algorithms, Flipped Exercises

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From the HTML quiz:

```
for (int p = 1; p < N; p = p*2)
     sum++;
```

Any questions?

Give the runtime in tilde notation for…

```
for (int p = 1; p < N*N*N; p = p*2)
     sum++;
```

A. $\sim N^3$
B. $\sim lg(N)$
C. $\sim 3\ lg(N)$
D. $\sim lg(N^3)$
E. $\sim log_3(N)$

Yes, you can generalize!

```
for (int p = 1; p < f(N); p = p*2)
     sum++;
```

Runtime is $\sim \lg\left(f(N)\right)$

Give the runtime in tilde notation for…

```
for (int p = 1; p < N*N*N; k = p*2)
  for (int q = 1; q < p; q++)
    sum++;
```

A. $\sim N^3$
B. $\sim N \lg(N)$
C. $\sim 3 \lg(N)$
D. $\sim 3N^3 \lg(N)$
E. $\sim 2N^3$

Common 226 mistake

```
for (int p = 1; p < N*N*N; k = p*2)
  for (int q = 1; q < p; q++)
    sum++;
```

- Cannot just multiply the order of growth of two loops!

Give the order of growth of the runtime for…

```
for (int p = 1; p*p <= N; p = p*2)
   sum++;
```

A. N^2
B. $\log(N)$
C. $\log(N^2)$
D. $N^{1/2}$
E. $\log(N^{1/2})$

Essentially correct, but orders of growth shouldn't include constants.

Similar to before...

```
for (int p = 1; p*p <= N; p = p*2)
  for (int q = 1; q < p; q++)
    sum++;
```

Give the order of growth of the runtime for…

```
for (int p = 1; p <= N; p = p*2)
   for (int q = 1; q <= N; q = q*2)
     for (r = 1; r <= p; r++)
        sum++;
```

A. log(N) log(N)
B. N log(N) log(N)
C. N log(log(N))
D. log(N)
E. N log(N)

Give the order of growth of the runtime for…

```
for (int p = 1; p <= N; p = p*2)
   for (int q = 1; q <= N; q = q*2)
     for (r = 1; r <= q; r++)
        sum++;
```

Only difference is q!

A. log(N) log(N)
B. N log(N) log(N)
C. N log(log(N))
D. log(N)
E. N log(N)

Fall 2010 Midterm Problem #1

- For each of the expressions below, determine whether it is $\sim\frac{1}{2}N^2$, $O(N^2)$, both, or neither.

___ $1 + 2 + 4 + 8 + 16 + \cdots + N$

___ $1 + 2 + 3 + 4 + 5 + \cdots + N$

___ $\frac{1}{2}N^2$

___ $\frac{1}{2}N^2 + 100N\lg N$

___ N^2

___ N^3