

Problems on Complexity Analysis

Find the Time Complexities of the following snippets of code:

(A)

```
/* Assume that rand() takes constant amount of time */
int a = 0, b = 0;
for (int i = 0; i < N; i++) {
    a = a + rand();
}
for (int j = 0; j < M; ++j) {
    b = b + rand();
}
```

(B)

```
int a = 0, b = 0;
for (int i = 0; i < N; i++) {
    for (int j = 0; j < N; j++) {
        a = a + j;
    }
}
for (int k = 0; k < N; k++) {
    b = b + k;
}
```

(C)

```
int a = 0;
for (int i = 0; i < N; i++) {
    for (int j = N; j > i; --j) {
        a = a + i + j;
    }
}
```

(D)

```
int a = 0, i = N;
while (i > 0) {
    a += i;
    i /= 2;
}
```

(E)

```
void fun(int N, int K) {
    for(int i = 1; i <= N; i++) {
        /* Assume that pow() takes constant amount of time */
        int P = pow(i, K);
        for (int j = 1; j <= P; ++j) {
            /* Some constant amount of computation */
        }
    }
}
```

(F)

```
int count = 0;
for(int i = N; i > 0; i /= 2) {
    for(int j = 0; j < i; j++) {
        count += 1;
    }
}
```

(G)

```
int k = 0;
for(int i = N/2; i <= N; ++i) {
    for (int j = 2; j <= N; j = j * 2) {
        k = k + N/2;
    }
}
```

(H)

```
int j = 0;
for(int i = 0; i < N; ++i) {
    while(j < N && arr[i] <= arr[j]) {
        j++;
    }
}
```

Match the following Time Complexities:

- | | | |
|------------------------|--|-----|
| (1) Linear | (A) N^{K+G} | () |
| (2) Logarithmic | (B) $5^{N \times 2}$ | () |
| (3) Exponential | (C) $\frac{N}{4} \log_2 \left(\frac{N}{4000} \right)$ | () |
| (4) Polynomial | (D) $3^{20}N + 10^5$ | () |
| (5) Linear Logarithmic | (E) $10N + 9 \frac{N}{100} + 340N^2$ | () |
| (6) Quadratic | (F) $10^3 \log_2(N+3N)$ | () |