

CSE 101 Practice Problems - big-O notation

Running-Time Analysis

For the pseudo-code below, give the asymptotic running time in Θ notation:

```
1. for i = 1 to n do
    j = i
    while j < n do
        j = j + 3
```

Answer: The running time is approximately the following sum: $\sum_{i=1}^n (n-i)/3$ which is $\Theta(n^2)$.

```
2. for i = 1 to n do
    for j = 2*i to n do
        s = s+1
```

Answer: The running time is approximately the following sum: $\sum_{i=1}^{n/2} n - 2i + \sum_{i=n/2+1}^n 1$ which is $\Theta(n^2)$.

```
3. for i = 1 to n do
    j = i
    while j < n do
        j = 2*j
```

Answer: The running time is approximately the following sum: $\sum_{i=1}^n 1 + \log(n/i)$ which is $\Theta(n)$.

```
4. for i = 1 to n do
    j = n
    while i*i < j do
        j = j - 1
```

Answer: The running time is approximately the following sum: $\sum_{i=1}^{\sqrt{n}} n - i^2 + \sum_{i=\sqrt{n}+1}^n 1$ which is $\Theta(n\sqrt{n})$.

```
5. for i = 1 to n do
    j = 2
    while j < i do
        j = j*j
```

Answer: The running time is approximately the following sum: $\sum_{j=2}^n \log \log i = \log \prod_{i=2}^n \log i$ The log of the product can be approximated with $\Theta(n \log \log n)$.

(source: Berkeley CS 170, Fall 2009, HW 1)