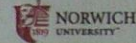


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IS228

DATA STRUCTURES



EXERCISES 1

Total Value: 50 points

Due Date: September 21, 2014 (1800)

1. Explain why saying "Algorithm X has a running time of at least $O(n^3)$," is meaningless. Why would saying "Algorithm X has a running time of at most $\Omega(n)$ " be similarly meaningless? (10 points)

Saying Algorithm X has a running time of at least $O(n^3)$ or at most $\Omega(n)$ is meaningless because $O(n^3)$ is a measure of worst case and $\Omega(n)$ is best case. therefore it makes no sense to say ~~algorithm~~ algorithm X will run in at least $O(n^3)$ or no worse than $\Omega(n)$

2. What is the running time of the following code in terms of n in Big-O notation? Show your work. (20 points)

```
// void f1(); // Runs in  $O(1)$  time  $\rightarrow C$ 
```

```
// void f2(int z); // Runs in  $O(z)$  time  $\rightarrow \text{A}$ 
```

```
int x = n * 2; 1 1  
for (int i = 0; i < x; i++)
```

0 {
f1(); $\rightarrow 1$
}

```
f2(x); A
```

$$n + 1 + 1 + 1 + 1 + \dots = 4 + n = 4 + n = 4 + 2n$$

runs in $O(n)$

3. What is the running time of the following code in terms of n in Big-O notation? Show your work. (20 points)

```
// void f1(int z); // Runs in  $O(1)$  time  $\rightarrow 1$ 
```

```
// void f2(int z); // Runs in  $O(z)$  time  $\rightarrow n$ 
```

$2n^3 \times n$

```
for (int i = 0; i < n; i++)  
{  
  for (int j = 0; j < n; j++)  
  {  
    for (int k = 0; k < n; k++)  
    {  
      f1(n);  
    }  
  }  
}
```

$$2n^3 + 2n^2 + 2n$$

$$2n^3 + 2n^2 + 2n + 1000n$$

runs in $O(n^3)$

$1000n$

```
for (int i = 0; i < 1000; i++)  
  f2(x); n
```

$$1000n$$

FALL 2014