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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 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 → c
// void f2(int z); // Runs in O(z) time → n
int x = n * 2;
for (int i = 0; i < x; i++)
{
  f1(); → 1
}
f2(x); n
```

$n + 1 + 1 + 1 + 1 + n = 4 + n + n = 4 + 2n$

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 -> 1
// void f2(int z); // Runs in O(z) time → n
for (int i = 0; i < n; i++)
{
  for (int j = 0; j < n; j++)
  {
    for (int k = 0; k < n; k++)
    {
      f1(n);
    }
  }
}
for (int i = 0; i < 1000; i++)
  f2(x); n
```

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

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

runs in $O(n^3)$