

ECE-250 – Algorithms and Data Structures (Winter 2012)
Tutorial 1 (2012-01-19)

1 - Show, using both the formal definition and the limit criterion, that the relationship Θ is symmetric; that is, show that $f(n) = \Theta(g(n)) \implies g(n) = \Theta(f(n))$

2 - Explain why the following statement is or is not true: Given two asymptotically non-negative functions $f(n)$ and $g(n)$, with $f(n) = \Theta(g(n))$, then it must be true that either $f(n) - g(n) = o(f(n))$ or $f(n) - g(n) = o(g(n))$.

3 - (a) Assuming that the array contains random values, evenly distributed, show that the variable `max` gets assigned $\lg n$ times on average:

```
int find_max (const int * array, int n)
{
    max = array[0];

    for (int i = 1; i < n; ++i)
    {
        if (array[i] > max)
        {
            max = array[i];
        }
    }

    return max;
}
```

(b) Given the above result, determine the run time (in asymptotic notation) for the function `find_max` (as a function of the argument n representing the size of the array)

4 - Solve the following recurrence relation: $f(n) = 4f(n/2) + \Theta(n)$, with $f(1) = \Theta(1)$