You will submit your solution to this assignment to the Curator System (as `HW02`). Your solution must be either a plain text file (e.g., NotePad) or a typed MS Word document; submissions in other formats will not be graded.

Except as noted, credit will only be given if you show relevant work.

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1. [25 points] Using the rules given in the course notes, perform an exact count complexity analysis, for the worst case, of the body of the following function.

```
void Mystery(int M[N][N], const int N) {

   for (int R = 0; R < N; R++) {
      for (int C = 1; C < N; C++) {
         if (M[R][C-1] < M[R][C])
            M[R][C-1] = M[R][C];
         else {
            M[R][C]   = M[R][C-1];
            M[R][C-1] = 0;
         }
      }
   }
}
```

   State both a complexity function T(N) and the Θ-complexity of T(N).

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2. [25 points] Consider the following function, where α is an unknown positive constant:

$$f(n) = n^{\alpha} + \log n$$

   Use Theorem 8 from the course notes on asymptotics to prove each of the following facts:

   a) $f(n)$ is $\Theta(n^{\alpha})$ if $\alpha > 0$

   b) $f(n)$ is $\Theta(\log n)$ if $\alpha < 0$

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3. [25 points] For each part, determine the simplest possible function g(n) such that the given function is $\Theta(g)$. No justification is necessary, but you might have to do some analysis using the theorems from the notes.

   a) $a(n) = 14n^2 + 3n \log n$

   b) $b(n) = 3n^2 \log n$

   c) $c(n) = 3n \log^2 n + 3n^2 \log n$

   d) $d(n) = 10n^2 + 2^n$

   e) $e(n) = \dfrac{1}{n}$

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4. [25 points] Suppose that executing an algorithm on input of size N requires executing T(N) = 3N log N + 16N instructions. How long would it take to execute this algorithm on hardware capable of carrying out 2^{25} instructions per second if $N = 2^{30}$? (Give your answer in hours, minutes and seconds, to the nearest second.)