Assignment 2: Algorithm Analysis

1. **Formally prove** the following results:

   (a) **(5 points)** $f_1(n) = n^2 + 10n \log n - 2n + 4$ is $O(n^2)$.

   (b) **(10 points)** $f_2(n) = (n+1)^5$ is $\Theta(n^5)$.

   (Hint: To formally prove the results, you need to use the definitions of the asymptotic notations and find the proper constants c and n_0.)

2. Show the following results:

   (a) **(5 points)** $\sum_{i=1}^{n} i^2$ is $O(n^3)$.

   (b) **(5 points)** $\sum_{i=1}^{n} \log_2(i)$ is $O(n \log n)$.

   (Hint: You don't need formally prove the results. Instead, you just need to demonstrate how the notations are inferred.)

3. **(10 points)** Express the following functions in big-Oh notations and order their growth rates:

   $10n \log n + 2n^2$, 4^{10}, $100 \log n + 2n$, $400n^{1/2}$, $20n^5 + 2^n$, $n^3 + 10n^2 + 100n$, $\log(n^5)$.