Some useful tex stuff

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*emphasized text*

1. (a) Let $f(x) = O(x)$ and $g(x) = O(x)$. Let $c$ be a positive constant.  
   Prove or disprove that $f(x) + c \cdot g(y) = O(x + y)$.
   (b) Let $f(n) = c_1 \cdot \log_b n$, and let $g(n) = c_2 \cdot \log_d n$.  
   Prove that $f(n) = \Theta(g(n))$.
   (c) Let $f(n) = \log n^{(1)}$, and let $g(n) = \Theta(\log n)$.  
   Prove that $f(n) = \Theta(g(n))$.

Now, to prove all of the above.

*Proof. No, not really, but here’s a QED box.*

Here’s another QED box, outside of the *proof environment*:

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2. Prove or disprove that $\sum_{x=1}^{n} (8x^2 - 4x + 60) = \Theta(n^3)$.

3. Express each of the following using $\Theta$-notation, if possible. You can use any reasoning that you like, as long as it is convincing.

   (a) $T(n) = T(\frac{57n}{2}) + \Theta(n^2)$
   (b) $S(n) = 2 \cdot S(\frac{10n}{9}) + \Theta(n)$

Let’s start a new page.
4. Use the master method to evaluate the following two functions, if possible.

(a) \( P(n) = 10 \cdot P\left(\frac{n}{4}\right) + \Theta(n^2 \log^5 n) \)
(b) \( Q(n) = 3 \cdot Q\left(\frac{n}{2}\right) + \Theta(n^2) \)

5. (a) Use the substitution method to prove:
\[ T(n) = 18T\left(\frac{n}{3}\right) + \Theta(n^2) = O(n^3). \]
(b) Is this the best possible upper bound for \( T(n) \)?

6. Let \( S_1 \) and \( S_2 \) be two sorted lists of numbers, with \( n \) and \( m \) elements respectively. Let \( m \leq n \). State how to find all common elements in \( S_1 \) and \( S_2 \), giving a time complexity \( T(m, n) \) that is as efficient as possible, and sensitive to the relative sizes of \( m, n \).

- Let me know what other symbols you’d like to see in this template.
- Your TAs will be happy if you type your homework