Worth: 2% **Due:** *Before* 10pm on **Wednesday 15** February 2012.

Remember to write your *full name* and *student number* prominently on your submission.
Please read and understand the policy on Collaboration given on the Course Information Sheet. Then, to protect yourself, list on the front of your submission ***every*** *source of information you used to complete this homework (other than your own lecture and tutorial notes, and materials available directly on the course webpage). For example, indicate clearly the* ***name*** *of every student with whom you had discussions, the* ***title*** *of every additional textbook you consulted, the* ***source*** *of every additional web document you used,* etc.

For each question, please write up detailed answers carefully. Make sure that you use notation and terminology correctly, and that you explain and justify what you are doing. Marks **will** be deducted for incorrect or ambiguous use of notation and terminology, and for making incorrect, unjustified, ambiguous, or vague claims in your solutions.

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1. Let $T(n)$ denote the worst-case running time of the algorithm below on inputs of size n. Write a recurrence relation satisfied by T. Make sure to define n precisely (as a function of the algorithm's parameters) and justify that your recurrence is correct (by referring to the algorithm to describe how you obtained each term in your answer). **Do *not* write down a closed-form expression for $T(n)$!** Just the recurrence itself.

```
MYSTERY(A, b, e):
    # A is a list and b, e are indices such that 0 ⩽ b ⩽ e + 1 ⩽ len(A).
    if b > e:  return 0
    m ← ⌊(e − b + 1)/4⌋
    s ← MYSTERY(A, b, b + m − 1)
    for i ← b + m to e − m:
        s ← s + A[i]
    s ← s + MYSTERY(A, e − m + 1, e)
    return s
```

2. Use the method of repeated substitution to find an approximate closed-form expression for $T(n)$ from the previous question. Show your work, *i.e.*, explain what you are doing at each step. **Do *not* write a formal proof of your answer!**

   HINT: Remember that $\forall a, b, c \in \mathbb{R}, a > 1 \wedge b > 1 \wedge c > 1 \Rightarrow a^{\log_b c} = c^{\log_b a}$.