Imperial College London – Department of Computing

MSc in Computing Science

580: Algorithms
Tutorial 2

1. (Part of a 2015 exam question.)

   (a) Using either Java or pseudocode, write a recursive procedure POW(x, N) to compute x^N, where N is a positive integer. Use a divide and conquer strategy. *Hint:*

   $$x^N = x^{N/2} \times x^{N/2} \qquad \text{for even } N$$
   $$x^N = x^{(N-1)/2} \times x^{(N-1)/2} \times x \qquad \text{for odd } N.$$

   (b) Write recurrence expressions for the time complexity $T(N)$ of your POW procedure in the following cases:

   $$T(N) = \begin{cases} \quad, \text{ if } 0 < N \leq c \\ \quad, \text{ if } N > c \end{cases}$$

   What is c?

   (c) Solve your expressions for $T(N)$ using the master method. Show each step.