**Problem 1:** For each piece of pseudo-code below, give its asymptotic running time as a function of $n$. Express this running time using the $\Theta()$ notation. (You don’t need to give any justification.)

<table>
<thead>
<tr>
<th>Pseudo-code</th>
<th>Running time</th>
</tr>
</thead>
</table>
| for $i \leftarrow 1$ to $2n$ do  
  for $j \leftarrow 1$ to $i$ do  
    $x \leftarrow 2x + 7$ | \[\Theta(n^2)\] |
| $j \leftarrow 1$  
  while $j < n$ do  
    $x \leftarrow 2x + 7$  
    $j \leftarrow j + 2$ | \[\Theta(n)\] |
| for $i \leftarrow 1$ to $n$ do  
  $j \leftarrow 1$  
  while $j < n$ do  
    $x \leftarrow 2x + 7$  
    $j \leftarrow 3j$ | \[\Theta(n^2)\] |
| for $i \leftarrow n/2$ to $n$ do  
  $x \leftarrow 2x + 7$  
  for $j \leftarrow 1$ to $3n$ do  
    $x \leftarrow 2x + 7$ | \[\Theta(n)\] |

Note 1: “$\leftarrow$” denotes the assignment statement. The scope of and nesting loops is indicated by the indentation.
Problem 2: (a) State Euclid’s Algorithm.

(b) Use Euclid’s Algorithm to compute the greatest common divisor of 323 and 456. Show your work. (No guessing, you must follow Euclid’s algorithm.)
Problem 3: (a) Compute $5^{40} \text{ rem } 13$. Show your work.

(b) Compute $5^{-1} \pmod{11}$. Show your work.