Questions (40pt, 8 pt each) Mark the right answer.

Q1: If \( f(n) = O(g(n)) \)
   A: \( g(n) \) is a lower bound for \( f(n) \)
   B: \( g(n) \) is an upper bound for \( f(n) \)
   C: \( f(n) \) is an upper bound for \( g(n) \)
   D: \( g(n) \) is a tight bound for \( f(n) \)

Q2: If \( f(n) = \Omega(g(n)) \)
   A: \( f(n) \) is an upper bound for \( g(n) \)
   B: \( g(n) \) is a tight bound for \( f(n) \)
   C: \( g(n) \) is an upper bound for \( f(n) \)
   D: \( f(n) \) is a lower bound for \( g(n) \)

Q3: If \( f(n) = O(n) \)
   A: \( f(n) = 7n^7+10n \)
   B: \( f(n) = n \log(n) \)
   C: \( f(n) = n^2 \)
   D: \( f(n) = 10000 n – 50 \)

Q4: if \( f(n) = \Theta(g(n)) \)
   A: \( \exists c > 0 \) and \( n_0 > 0 \) s.t. \( 0 \leq c g(n) \leq f(n), \forall n \geq n_0 \)
   B: \( \exists c_1, c_2 > 0 \) and \( n_0 > 0 \) s.t. \( 0 \leq c_1 g(n) \leq f(n) \leq c_2 g(n), \forall n \geq n_0 \)
   C: \( \exists c > 0 \) and \( n_0 > 0 \) s.t. \( 0 \leq c f(n) \leq g(n), \forall n \geq n_0 \)
   D: \( \exists c > 0 \) and \( n_0 > 0 \) s.t. \( 0 \leq f(n) \leq c g(n), \forall n \geq n_0 \)

Q5: An algorithm with complexity \( O(n^2) \)
   A: Has an input of length \( n^2 \)
   B: Has \( n^2 \) instructions
   C: Has an execution time that grows quadratically with the size of the input
   D: Has an execution time that grows quadratically with the number of instructions
Problem 1 (20 pt)
Show the execution of INSERTION SORT on the following array. Detail as much as possible the steps executed by the algorithm.

3 2 7 4
Problem 2 (20 pt)

Consider the following algorithm and analyze its big O complexity. Justify your answer by referring to the specific properties of asymptotic notation.

Note that the code has not particular meaning or purpose.

MyFunction(A,n){
    sum = 0;
    For i = 1 to n {
        sum+=i;
    }
    For i = n down to n/2 {
        sum+=i;
    }
    For j = 1 to n {
        For k = 1 to n {
            For j = 1 to n/3 {
                Print sum+i+j+k
            }
        }
    }
    return sum;
}
Problem 3 (20 pt)

Show that if \( f(n) = 7n^2 - n - 5 \) then \( f(n) = \Theta(n^2) \)