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

Q1: If $f(n) = O(g(n))$
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: $g(n)$ is a lower bound for $f(n)$

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

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

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

Q5: An algorithm with complexity $O(n^2)$
A: Has $n^2$ instructions
B: Has an input of length $n^2$
C: Has an execution time that grows quadratically with the number of instructions
D: Has an execution time that grows quadratically with the size of the input
Problem 1 (25 pt)
Show the execution of INSERTION SORT on the following array. Detail as much as possible the steps executed by the algorithm.

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1  7  5  2
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Problem 2 (15 pt)

Explain best and worst case of INSERTION SORT. Justify your answer.
Problem 3 (20 pt)

Show that if \( f(n) = 4n^2 + 4 \) then \( f(n) = O(n^2) \)