Problem 1. Which of the following is true? Answer: [  ]
A. \( \log_2 n = \Omega(n) \). \hspace{1cm} B. \( n = \Omega(\log_2 n) \).

Answer: \( B \)

Problem 2. Which of the following is true? Answer: [  ]
A. \( 395\sqrt{n} + 29(\log_2 n)^5 + \frac{n^{0.501}}{\log_2 n} = O(\sqrt{n}) \).
B. \( 395\sqrt{n} + 29(\log_2 n)^5 + \frac{n^{0.501}}{\log_2 n} = \Omega(\sqrt{n}) \).
C. Neither of the above.

Answer: \( B \)

Problem 3. Which of the following is not an atomic operation of the RAM model? Answer: [  ]
A. Calculate \( ab \) where integers \( a, b \) are stored in registers.
B. Calculate \( a^b \) where integers \( a, b \) are stored in registers.
C. Compare the integers stored in two registers.
D. Write the content of register \( a \) into the memory cell whose address is stored in register \( b \).

Answer: \( B \)

Problem 4. Which of the following is true? Answer: [  ]
A. \( n(\log_2 n)^2 = O(n \log_{200} n) \).
B. \( n^{1.001} / \log_{2000} n = \Omega(n \log n) \).
C. \( n = \Theta(n \log n) \).
D. \( n^{0.001} = O((\log n)^{96328}) \).

Answer: \( B \)

Problem 5. Which of the following functions is not \( O(n^{3.5}) \). Answer: [  ]
A. \( 28532 \cdot n^2 \)
B. \( (\log_2 n)^{989} \)
C. \( (\log_2 n)^{\log_2 n} \)
D. \( 2^{3 \log_2 n} \)

Answer: \( C \)

Problem 6. Which of the following functions is \( O(n \log \sqrt{n}) \). Answer: [  ]
A. \( n^{1.35} / \log^{100000} n \)
B. \( 8n \log_{1.001} n \)
C. \( n \cdot (\log_2 n)^{1.05} \)
D. \( (1.01)^{\sqrt{n}} \)

Answer: \( B \)

Problem 7. Which of the following functions is \( \Omega(n^{1.35}) \). Answer: [  ]
A. \( n^{1.35} / \log^{100000} n \)
B. \( 8n \log_{1.001} n \)
C. \( n \cdot (\log_2 n)^{1.05} \)
D. \( (1.01)^{\sqrt{n}} \)

Answer: \( D \)

Problem 8. Which of the following functions is \( \Theta(n \log n) \). Answer: [  ]
A. \( n^{1.35} / \log^{100000} n \)
B. \( 8n \log_{1.001} n \)
C. \( n \cdot (\log_2 n)^{1.05} \)
D. \( (1.01)^{\sqrt{n}} \)
Problem 9. Is the following statement correct?
“Suppose that we have two algorithms A1, A2 for sorting n integers. Their worst case running times are $O(n \log n)$ and $O(n^2)$, respectively. But still, the cost of A1 may be higher than that of A2 on some inputs.”

Answer: Yes.
Problem 10. Prove or disprove: $n^2 + \sqrt{n} = O(n^3)$.

Answer: It’s correct. For a proof, it suffices to find constants $c_1, c_2$ such that $n^2 + \sqrt{n} \leq c_2 \cdot n^3$ for all $n \geq c_1$. Setting $c_1 = 2$ and $c_2 = 1$ fulfills the purpose.