Problem 1. Which of the following is not an atomic operation of the RAM model?
Answer: [   ]
A. Calculate $a + b$ where $a$ and $b$ are stored in two registers.
B. Sort an array of $n$ integers for an arbitrary value of $n$.

Problem 2. Which of the following is true? Answer: [   ]
A. $n \log_2 n = O(n)$.   B. $n = O(n \log n)$.

Problem 3. Which of the following is true? Answer: [   ]
A. $n^2 = \Omega(n)$.   B. $n = \Omega(n^2)$.

Problem 4. Which of the following is true? Answer: [   ]
A. $100n + \sqrt{n} + (\log_2 n)^5 = \Theta(n)$.   B. $100n + \sqrt{n} + (\log_2 n)^5 \neq \Theta(n)$.

Problem 5. Which of the following functions of $n$ is not $O(n^2)$. Answer: [   ]
A. $n^2 / \log^2 n$   B. $(\log_2 n)^{35}$   C. 100000   D. $\frac{x^{2.001}}{3583}$   E. $\frac{n^3}{2n}$

Problem 6. Which of the following functions of $n$ is $O(n)$. Answer: [   ]
A. 100000   B. $n^2 / \log^2 n$   C. $\frac{n^{2.001}}{3583}$   D. $(1.01)^n$   E. $n \log_2 n$

Problem 7. Which of the following functions of $n$ is $\Omega(n)$. Answer: [   ]
A. 100000   B. $n^2 / \log^2 n$   C. $n^{0.999}$   D. $(1.01)^n$   E. $(\log_2 n)^{35}$

Problem 8. Which of the following functions of $n$ is not $\Theta(n \log n)$. Answer: [   ]
A. $35n \log_2 n + \sqrt{n}$   B. $n \log_35 n$   C. $n^{1.81} + n \log_2 n$   D. $n^{0.99} + 87n \log_{200} n$.

Problem 9. Which of the following statements is true? Answer: [   ]
A. The running time of binary search (performed on a sorted array of $n$ integers) is $O(\log^2 n)$.
B. The running time of binary search (performed on a sorted array of $n$ integers) is $O(1)$.
C. $35n + \sqrt{n} = \Theta(n^2)$.
D. In the RAM model, the time complexity of an algorithm depends on how fast a CPU is (the complexity on a 2 GHz CPU may be different from that on a 1 GHz one).

Problem 10. Prove $10n + n^{1/3} = O(n)$. 
COMP7505: Quiz 1

Name: 
Student ID: 

This is the quiz paper for COMP7505. If you are registered for COMP3506, turn overleaf.

Problems 1-8 bear 10 marks each. Problem 9 bears 20 marks.

Problem 1. Which of the following is true? Answer: [ ]
A. \( n \log_2 n = O(n) \).  
B. \( n = O(n \log n) \).

Problem 2. Which of the following is true? Answer: [ ]
A. \( 100n + \sqrt{n} + (\log_2 n)^5 = \Theta(n) \).  
B. \( 100n + \sqrt{n} + (\log_2 n)^5 \neq \Theta(n) \).

Problem 3. Which of the following functions of \( n \) is not \( O(n^2) \). Answer: [ ]
A. \( n^2/\log^2 n \)  
B. \( (\log_2 n)^{35} \)  
C. 100000  
D. \( \frac{n^{2.001}}{3383} \)  
E. \( \frac{n^3}{2\pi} \)

Problem 4. Which of the following functions of \( n \) is \( O(n) \). Answer: [ ]
A. 100000  
B. \( n^2/\log^2 n \)  
C. \( \frac{n^{2.001}}{3383} \)  
D. \( (1.01)^n \)  
E. \( n \log_2 n \)

Problem 5. Which of the following functions of \( n \) is \( \Omega(n) \). Answer: [ ]
A. 100000  
B. \( n/\log^2 n \)  
C. \( n^{0.999} \)  
D. \( (1.01)^n \)  
E. \( (\log_2 n)^{35} \)

Problem 6. Which of the following functions of \( n \) is not \( \Theta(n \log n) \). Answer: [ ]
A. \( 35n \log_2 n + \sqrt{n} \)  
B. \( n \log_3 n \)  
C. \( n^{1.81} + n \log_2 n \)  
D. \( n^{0.99} + 87n \log_{200} n \)

Problem 7. Which of the following statements is true? Answer: [ ]
A. The running time of binary search (performed on an array of \( n \) integers) is \( O(\log^2 n) \).
B. The running time of binary search (performed on an array of \( n \) integers) is \( O(1) \).
C. \( 35n + \sqrt{n} = \Theta(n^2) \).
D. In the RAM model, the time complexity of an algorithm depends on how fast a CPU is (the complexity on a 2 GHz CPU may be different from that on a 1 GHz one).

Problem 8. Prove \( 10n + n^{1/3} = O(n) \).

Problem 9. Let \( f(n) \) and \( g(n) \) be two functions of integer \( n \). Prove: if \( f(n) = O(g(n)) \), then \( \frac{f(n)}{g(n)} = O(1) \).