CSCI2100 Quiz 1

Name: Student ID:

Each of the following problems bears 10 marks. There is only one correct answer for each problem.

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

Answer: *B*

Problem 2. Which of the following is true? Answer: [ ]

A. $395\sqrt{n} + 29(\log_2 n)^5 + \frac{n^{0.501}}{(\log_2 n)^{500}} = O(\sqrt{n})$.

B. $395\sqrt{n} + 29(\log_2 n)^5 + \frac{n^{0.501}}{(\log_2 n)^{500}} = \Omega(\sqrt{n})$.

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. $n^{0.001} = O((\log n)^{95328})$

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. $(1.01)^{\sqrt{n}}$

Answer: B

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: [ ]

Answer: Yes.

- Please turn overleaf -

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.