

Due Monday September 10, 11:59PM

Running Time Analysis

1. Write a C function that takes an array of n integers and prints out all pairs to the standard output. Given $\{a, b, c\}$, the function should print out (a, b) , (a, c) , (b, a) , (b, c) , (c, a) , (c, b) , regardless of the values of a , b , and c .
2. Measure the function's running time as a function of n .
 - a. Generate random input arrays and time the function.
 - b. Double the value of n starting from 64 until the running time becomes greater than 20 seconds.
 - c. Plot the running time as a function of n on both a linear and a logarithmic graph.
3. Write a pseudocode description of the function.
 - a. Find the number of primitive operations as a function of n .
 - b. Perform the asymptotic running time analysis using the O , Ω , Θ , ω , and o notations.
 - c. Argue that the problem of printing out all pairs is $\Theta(n^2)$.
4. Consider a function that prints out unordered pairs. For the example above, the pairs printed are (a, b) , (a, c) , and (b, c) . How does the actual running time change? Does the asymptotic running time change? Explain.
5. **Extra-credit:** Write a function that prints all pairs (a, b) where both a and b are multiples of 5, and that has a linear best case running time. What is the worst case running time? What is the average case running time? Explain. (3%)
6. Turn in instructions:
 - a. Assignment specific
 - i. For turn in purposes, set up your function for question 1 with a main function that accepts input from the stdin and then calls the function; the main function should read in the length of the array n and then each of the array elements.
 - ii. Turn in a PDF document with your answers to questions 2-4.
 - iii. Question 5 requires separate code and PDF.
 - b. General: see website