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CIS 351 – HW5

1) If you take the limit as n goes to infinity of (n3) divided by (10000000n2) then you get the limit of infinity. This means that f(n) is in Ω(10000000n2) but not in O(10000000n2) or Θ(10000000n2).

2) If you take the limit as n goes to infinity of ((log2(n))100) divided by (log2(n100)) then you get the limit of infinity. This means that f(n) is in Ω(log2(n100)) but not in O(log2(n100)) or Θ(log2(n100)).

3) If you take the limit as n goes to infinity of (49n + (log2(n))4) divided by (5(log2(n))76) then you get the limit of zero. This means that f(n) is in O(5(log2(n))76), but not in Θ(5(log2(n))76) or Ω(5(log2(n))76).

4) If you take the limit as n goes to infinity of (6n/2) divided by (6n) then you get the limit of zero. This means that f(n) is in O(6n), but not in Θ(6n) or Ω(6n).

5) If you take the limit as n goes to infinity of (n100) divided by (2sqrt(n)) then you get the limit of infinity. This means that f(n) is in Ω(2sqrt(n)) but not in O(2sqrt(n)) or Θ(2sqrt(n)).

6) If you take the limit as n goes to infinity of (17log2(n)) divided by (nlog2(17)) then you get the limit of zero. This means that f(n) is in O(nlog2(17)), but not in Θ(nlog2(17)) or Ω(nlog2(17)).

7) If you try to take the limit as n goes to infinity of ((9+2cos(n))\*n2+12n) divided by (n2) you get undefined; therefore, we can’t use the limit rule. To find if f(n) is an element of Θ(n2), you need to find an upper and lower bound constant. To prove that f is in O(n2), we need to find an upper bound constant. To do this, we can say that ((9+2cos(n))\*n2+12n) is less than or equal to ((9+2cos(n))\*n2+12n2) for all n > 1. To prove that f is in Ω(n2), we need to find a lower bound constant. To do this, we can say that 9n2 is less than or equal to ((9+2cos(n))\*n2+12n) for all n > 0. Since f is in O(n2) and Ω(n2); therefore, f is in Θ(n2).

For ((9+2cos(n))\*n+12n2), if you take the limit as n goes to infinity of ((9+2cos(n))\*n+12n2) divided by (n2), then you get the limit of 12. Since the limit is not undefined, you can see that ((9+2cos(n))\*n+12n2) is in Θ(n2).

8) Θ(n) because the loop runs from zero to (n+1) and increments n by one every iteration, as well as incrementing z by one every iteration. The run time would be (n+1), but since z starts at one and i starts at 0, z would be equal to (n+1)-1, so n for n>0.

9) Θ(2n) because the outer loop runs from zero to (n+1) and increments n by one every iteration. The inner loop runs 2n times and decrements j every iteration, while also incrementing z by one every iteration. The outer loop run time would be (n+2), but since z starts at one, it would be (n+2)-1=n+1. By adding the two run times of each loop together, you get 2n+n+1 for n>0.

10) Θ(n2) because the outer loop runs from one to n and increments n by one every iteration. The inner loop runs from zero to n-1 and increments j by one every iteration, while also incrementing z by one every iteration. By implementing similar math to that of example problem 12 to find the total number of executions, you get 1/2n2+1/2n for all n>0 and since z starts at one, you just add one to it: 1/2n2+1/2n+1.

11) Θ(log2(n)) because the loop starts at one and ends at (n-1). Every iteration it increments m by two times m and increments z by one. Since m increases exponentially, you can figure that the total run time is related to nlog(n) because it runs from m is equal to one to n-1. This is because the increase in m exponentially is represented as 2n and when you convert that to a logarithmic expression, you get log2(n).