Question 7.

Algorithms Assignment 1

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1 Listing from smallest to largest complexity

$2\log_{10} 10^{200}$, 10^{200} Constant time ($O(1)$)
They belong to the same class as they have a constant size. The complexity does not depend on the value of n.

$n^2 + \sqrt{n}$, $n^2 + 7\log n^2$, $n^2 \log 300$ Polynomial (Quadratic, $O(n^2)$) time
These expressions all belong to the same complexity class as they are bound by n^2. We know this because n^2 is the largest term in each of the expressions, and is hence the largest bound.

$n^2 \log n$ Polynomial time ($O(n^2 \log n)$)
This is not as simple as putting it in under $O(n^2)$, as the $log(n)$ term is multiplying, and will hence always overtake $c \cdot n^2$ as n grows infinitely large. The bound for this can also be given as $O(n^3)$, however, the immediate tightest bound is still in the form $O(n^2 \log n)$

g n^4, $n^4 + n^2 + n^2 \log n$ Polynomial time (Quartic, $O(n^4)$)
All of the expressions belonging to this class have n^4 as the largest term, and hence n^4 bounds the equation. Hence, we can say that they belong to the same complexity class.

3^{n^2} Exponential time ($k^{f(n)}$)