CS3230 – Assignment 1
Due Date: 14th February 2018, before start of class

Student Number _____

Question	Marks
Q1	
Q2	
Q3	
Total	

1. State whether true of false, and give justification for your answer.

   (a) (2 points) $n^2 * \sqrt{n}$ is in $\Omega(n^2 \log n)$.

   (b) (2 points) $\log_2 \log_2 n$ is in $\Theta(\log_{10} \log_{10} n)$.

   (c) (2 points) $\frac{3^n}{n^5}$ is in $O(\frac{2^n}{n^2})$.

   (d) (2 points) If $f \notin O(g)$, then $g \in O(f)$.

2. Give asymptotic tight bounds for $T(n)$ in the recurrence relations below. Give proof sketch for your answer.

   (a) (3 points) $T(n) = 4T(n/6) + n$

(b) (3 points) $T(n) = \sqrt{n} * T(\sqrt{n}) + 100n$.

Hint: Master Theorem does not apply to part (b). Try simplifying the formula for few iterations, and see what gets added in each iteration and how many iterations are needed.

3. (6 points) Suppose we are given a collection of n nuts, each of different size, along with corresponding bolts. However, as the nuts and bolts were mixed up, we don't know which nut matches which bolt.

   Suppose we can only compare a nut with a bolt to determine if they match, or not. Here, if the nut/bolt do not match, then we can know whether the nut is smaller in size or bigger in size with respect to the bolt.

   Note that you cannot compare one bolt with another, or one nut with another.

   Give an algorithm to find matching nuts/bolts. What is the average case complexity of your algorithm? You may use results/algorithms done in class to argue about your algorithm's efficiency.

   Your marks for this question will depend on average case efficiency of your algorithm.