Algorithms Worksheet 2

For each part of a question write the answer and include workings. Each question is worth two marks, there are also two marks for attendance.

1. Solve for $T(n)$ using the ansatz $T(n) = r^n$ for the following two step recursion relations. Solving for r will give two values r_1 and r_2, this means that the general solution will be $T(n) = Ar_1^n + Br_2^n$. Use the two base values to find A and B.

   a) $T(n) = 2T(n-1) + 3T(n-2)$ with $T(0) = 0$ and $T(1) = 4$.

   b) $T(n) = T(n-2)$ with $T(0) = 0$ and $T(1) = 2$.

2. This question is about the master theorem. Use it to calculate big-Theta for $T(n)$ in each case.

   a) $T(n) = 25T(n/5) + 4n^2$

   b) $T(n) = 20T(n/5) + 4n$

   c) $T(n) = 16T(n/2) + 2n^4$

3. This question is about quicksort; use the quicksort algorithm to sort the set $\{4, 7, 8, 10, 1, 2, 5, 9, 3, 6\}$ showing all your steps, use the median of triples on the first three entries to find the pivot; you don't need to go through the individual swaps involved in the in-place implementation, just divide the set around the pivot.

4. This question is about quicksort in place; perform the first step of quicksort, dividing the set into two, on the set $\{4, 7, 8, 10, 1, 2, 5, 9, 3, 6\}$ using the pivot 7 and individual swaps.