Algorithms Worksheet 2

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

1. Solve
$$T(n) = -T(n-1) + 4 \tag{1}$$
with $T(0) = 1$.

2. 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 $T(1) = 2$.

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

4. Bubble sort $(3, 5, 2, 8, 4)$ showing each step.

Extra question to do at home if you want: write a recursive version of quicksort to show that in the worst case
$$T(n) = T(n-1) + cn \tag{2}$$