Problems for Recitation 6

Problem 1. **(a)** Show that the Master Theorem does not apply to

$$S(m) = S(m/2) + (\log m)^2.$$

(b) Find a $\Theta()$ bound for S anyway.

(c) Find a $\Theta()$ bound for

$$T(n) = T(\sqrt{n}) + (\lg \lg n)^2.$$

The base condition is $T(2) = 1$.

Problem 2. **Life and Death.** In ancient Mars, cannibalism was an essential way of life. The Marons and the Batons were two species that lived for several thousand years in close contact. Every year, first all the Marons sustained themselves by first consuming Batons: two Marons ate one Baton between them. Then they reproduced: one-year-old Marons doubled in number while Marons that were two or older tripled in number. Then the surviving Batons consumed one Maron each and then all the Batons reproduced to quadruple in number. This cycle repeated every year. After 1 year there were two 1-year old Marons and two 1-year old Batons. After 2 years there were two 1-year olds and two 2-year olds in each of the two species. How many of each will there be of each species at the end of n years?