Homework 6

Homework rules:

- Homeworks are due one week after they are handed out, unless otherwise specified. *No late homeworks accepted!*
- Feel free to talk to other members of the class in doing your homework. I'm more concerned that you learn how to solve the problem, than that you demonstrate that you solved it entirely on your own. You should, however, write up your solution yourself. Please try to keep solutions brief and clear. You may refer to the literature, but do not refer to handouts from previous years' classes (in case I repeat some problems from previous years).

Due Wednesday, October 26

Problem 1.

Suppose we have a bag of black and red marbles. The initial contents of the bag are chosen according to the following rule: for each $k \geq 1$, with probability 2^{-k} the bag contains k black marbles and 1 red marble. Furthermore, assume that once the initial set of marbles has been chosen, we have a reset procedure that returns the bag to the *same* initial state.

We can then generate a string $s \in \{B, R\}^*$ using the following procedure: randomly remove a marble from the bag. If the marble is black, add *two* black marbles to the bag (i.e., the one you just removed and an additional one), output a 'B', and continue to randomly select another marble. If the marble is red, output an 'R' and halt.

Suppose that we perform 3 experiments (calling the reset procedure after each one) which generate the strings R, BBBR, and BR.

(a) Use the MAP method to predict the number of black (and red) marbles initially in the bag.

(b) Express this problem in terms of the minimum description length principle.