1. R-3.18 (Insertion into a skip list.)

2. Suppose that, instead of flipping a random coin, the level of each item in a skip list is decided deterministically as follows: the \( i \)th item is inserted at level \( k \) (and all levels below) if and only if \( i \) is divisible by \( 2^k \). (The first item is item number 1, and the first level is level 0.)

For example, the first item is only on level 0, since 1 is only divisible by 1 = \( 2^0 \). The second item is also on level 1, since 2 is divisible by \( 2 = 2^1 \). Thus, the levels of the first 16 items are:

\[
0, 1, 0, 2, 0, 1, 0, 3, 0, 1, 0, 2, 0, 1, 0, 4
\]

(a) Let \( n_k \) be the number of items in list \( S_k \) at height \( k \). Show that \( n_k = \lfloor n_{k-1}/2 \rfloor \).

(b) Describe a sequence of \( n \) key insertions that would result in a skip list where finding an item runs in time \( \Theta(n) \). Explain why this is the case. Your sequence should generalize to any positive integer \( n \). Your key values may be any real-valued numbers, positive or negative.

3. Complete the following hash table exercises:

(a) R-2.19

(b) R-2.20

(c) R-2.21

4. C-2.34 (Pseudocode for deletion without a special removal marker.)