Bundles: The problems in each homework assignment will be divided into 2 groups (to facilitate distribution to grading TAs). You will turn in 2 corresponding bundles. Write your name in the upper left corner of each bundle’s top page, with your last name printed clearly in CAPITAL LETTERS. Each bundle should be stapled separately. We don’t supply the stapler.

This week’s turnin bundles: (A) problems 1–2, (B) problems 3–4.


1. Definition 4 in Section 5.3 [6th edition: Definition 5 in Section 4.3] defines an extended binary tree. If \( T_1 \) and \( T_2 \) are both empty, \( T_1 \cdot T_2 \) is called a leaf. For example, the last tree in Figure 3 of Section 5.3 [6th edition: Section 4.3] has 2 leaves and the next to last tree in that figure has 3 leaves. The height of an extended binary tree is the distance from the root to the farthest leaf. All the trees in Step 3 of Figure 3 have height 2. (Note that the height is considered to be 2 rather than 3: it’s the number of edges on the longest root-to-leaf path rather than the number of nodes.) By induction, prove that, for any nonnegative integer \( h \), any extended binary tree with height \( h \) has at most \( 2^h \) leaves. Be careful of the possibility that your tree has one empty subtree and one nonempty subtree. (Hint: it will be simplest if your induction mirrors the recursive definition given in Definition 4 [6th edition: Definition 5].)

2. Section 9.5 [6th edition: Section 8.5], exercise 16.

3. Section 9.5 [6th edition: Section 8.5], exercise 40. The answer to part (b) should show that there is a one-to-one correspondence between the equivalence classes of \( R \) and the elements of a very familiar mathematical set.

4. Page 635 [6th edition: Page 584], Supplementary Exercise 10. (“A relation \( R \) is called circular ...”)