

Math 11200/20 homework 2  
Due date: Friday, October 7, 2016

Note: You shouldn't need to use a calculator for these problems.

Please present your solutions clearly and in an organized way. Think of it this way: if you show it to another student in this class, he/she should be able to understand it without needing to ask you questions.

**Problem 2.1.** Problem 1.16 from the textbook.

**Problem 2.2.** Let  $S = \{a, b, \dots, z\}$  be the set of letters in the English alphabet. We can form a “word of length  $n$ ” by writing  $n$  letters side by side. For example, *apple* is a word of length 5 and *abcd* is a word of length 4. There is a unique word of length 0, which we denote by  $\epsilon$  (the Greek letter epsilon).

Let  $W$  be the set of all words. We define  $\star : W \times W \rightarrow W$  to be the *concatenation* operator. For example,  $abc \star xyz = abcxyz$  and  $apple \star pen = applepen$ .

- (1) What is  $(pineapple \star pen) \star (apple \star pen)$ ?
- (2) Is  $\star$  associative? Is it commutative?<sup>1</sup> Does it have an identity? Which elements have inverses?

**Problem 2.3.** Problem 1.35 from the textbook.

**Problem 2.4.** Problem 1.36 from the textbook.

**Problem 2.5.** Problem 1.39 from the textbook.

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<sup>1</sup>Contrast that with this video that my mom sent me: <https://www.youtube.com/watch?v=0E00Zuayv9Q>