# Solutions to Abstract Algebra (Dummit and Foote 3e)
# Chapter 1 : Group Theory

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February 11, 2012

This work was done as an undergraduate student: if you really don't understand something in one of these proofs, it is very possible that it doesn't make sense because it's wrong. Any questions or corrections can be directed to jason.rosendale@gmail.com.

## Exercise 1.1.1

(a) is not associate: $3 - (2 - 1) \neq (3 - 2) - 1$. (b),(c),and (d) can be shown to be associative by grinding out the algebra and showing that $a * (b * c) = (a * b) * c$. (e) is not associative, as can be shown by letting $a = b = c = 2$.

## Exercise 1.1.2

(a) and (e) can be shown to not be commutative by letting $a = 1, b = 2$. (b),(c) and (d) can be shown to be commutative by grinding out the algebra.

## Exercise 1.1.3

$$\overline{a + b + c}$$
$$= a + \overline{b + c} \quad \text{def. of modular addition}$$
$$= a + \overline{b + c} \quad \text{def. of modular addition}$$

## Exercise 1.1.4

$$\overline{ab} \cdot c$$
$$= a \cdot \overline{b} \cdot c \quad \text{def. of modular multiplication}$$
$$= a \cdot \overline{bc} \quad \text{def. of modular multiplication}$$

## Exercise 1.1.5

To be a group, each element $a$ would need a multiplicative inverse $b$ such that $ab = 1$; but $\bar{0}$ has no such inverse.

## Exercise 1.1.6

(b) is not closed: $1/14 + 1/14 = 1/7$. (c) is not closed: $2/3 + 2/3 = 4/3$. (d) is not closed: $2 + (-3/2) = 1/2$. (f) is not closed: $1/2 + 1/3 = 5/6$. (a) and (e) are groups under addition.

## Exercise 1.1.7

That $x * y$ is well-defined follows directly from the fact that $+,-,$ and the greatest integer function are well defined on $\mathbb{R}$. To prove that $G$ is a group: $G$ has an identity element ($0 \in G$ and $0 * x = x * 0 = x - [x] = 0$), each

# [Abstract Algebra Dummit And Foote Solutions](#)

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**Abstract Algebra Dummit And Foote Solutions:**

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