

# Discrete Mathematics with Applications

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## Chapter 4

**Theorem 1.**  $\forall$  even integers  $m$  and odd integers  $n$ ,  $m + n$  is odd.

*Proof.* Suppose  $m$  is any even integer and  $n$  is any odd integer. By definition of even,  $m = 2r$  for some integer  $r$ , and by definition of odd,  $n = 2s + 1$  for some integer  $s$ . By substitution and algebra,

$$m + n = 2r + 2s + 1 = 2(r + s) + 1$$

Since  $r$  and  $s$  are both integers, so is their sum  $r + s$ . Hence  $m + n$  has the form twice some integer plus one, and so  $m + n$  is odd by definition of odd.  $\square$

**Theorem 2.** *Second theorem.*