

## Deciding when Strong Induction is necessary

Suppose you are asked to prove a theorem about a recursively defined set or function. If that definition depends only on the previous value, then simple induction will work. Otherwise you probably need strong induction.

Suppose you are asked to establish a bound on each of the following functions; would you need strong induction, or would weak induction suffice?

1.  $f(1) = 0, f(n) = 3f(n - 1) + 1$  if  $n \geq 2$
2.  $g(1) = 0, g(2) = 3, g(n) = 2g(n - 1) + g(n - 2)$  if  $n \geq 3$
3.  $h(1) = 3, h(2) = 3, h(n) = h(n - 1) + h(n - 2)$  if  $n \geq 3$
4.  $k(3) = 4, k(4) = 5, k(n) = k(n - 2)$  if  $n \geq 5$
5.  $p(1) = \text{True}, p(2) = \text{False}, p(n) = p(n - 1) \vee p(n - 2)$  if  $n \geq 3$
6.  $q(1) = \text{True}, q(2) = \text{False}, q(n) = \neg q(n - 1)$  if  $n \geq 3$