

Solving Recurrence Relations, Continued

- Is there another way? In general, probably not, but there are some formulas for some frequently-occurring special cases.
- One is "first-order linear" recurrence relations with constant coefficients. If

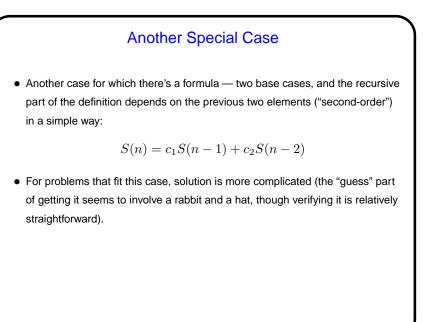
$$S(n) = cS(n-1) + g(n)$$

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then we can show (see textbook for derivation) that 
$$\label{eq:nonlinear}$$

$$S(n) = c^{n-1}S(1) + \sum_{i=2}(c^{n-i}g(i))$$

• Apply this to the two problems we did earlier — we should get the same results.



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## Another Special Case — Solution • First find roots $r_1$ and $r_2$ of $t^2 - c_1 t - c_2 = 0$ • and then (if $r_1 \neq r_2$ ) find p and q to solve p + q = S(1) $pr_1 + qr_2 = S(2)$ • and then the formula is $S(n) = pr_1^{n-1} + qr_2^{n-1}$ • Example: Fibonacci sequence (problems 24 in 2.4, 31 in 2.5).

