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1. Determine the number a_n of n-digit numbers with each digit odd, where the digits 1 and 3 occur an even number of times.

2. Show that the generating function of the Stirling number sequence $S(0,k), S(1,k), S(2,k)\ldots$ is

$$g_k(x) = \frac{x^k}{(1-x)(1-2x)(1-3x)\cdots(1-kx)}.$$

Hint: Use the recursive formula. Build $g_k(x)$ from $g_{k-1}(x)$.

3. Use the generating function $g_k(x)$ found in Problem 2 to

a. get a formula for $S(m,k)$. Hint: Use partial fractions.

b. show that $S(n,k) \equiv_2 \binom{n-j-1}{n-k}$ where $j = \lfloor k/2 \rfloor$.