

# Discrete Mathematics and Applications

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## 1 A selection of practice recurrence relations problems

### 1.1 Simple drills

1. Solve:  $a_n = a_{n-1} + 6a_{n-2}$ ,  $a_0 = 0, a_1 = 1$ .
2. Solve:  $a_n = \sum_{i=0}^{n-1} a_i$   $a_0 = 1$ .
3. Find the general solution to:  $a_n = 2a_n + 3a_{n-2} + 2^n - 1$ .
4. Solve:  $a_n = 2a_{n-1} - 3a_{n-2}$ ,  $a_0 = 1, a_1 = 2$ .
5. List all the binary sequences of length 8 that contain four 1's and four 0's such that when scanning from left to right the number of 1's is never less than the number of 0's.

### 1.2 More challenging problems

1. Solve the recurrence relation  $a_n = \sqrt{a_{n-1}a_{n-2}}$   $a_0 = 9, a_1 = 1$ . Is this sequence bounded? Can you find its limit?
2. Show that  $(6 + \sqrt{37})^{10000}$  has at least 10000 (moui nghin) 0's after the decimal point.
3. Show that  $\forall n \geq 1$   $(\sqrt{2} - 1)^n = \sqrt{m+1} - \sqrt{m}$  for some positive integer  $m$ .