

# Lecture 11

10 September 2021 10:01

Q7. Find a recurrence relation and give initial conditions for the number of bit strings of length  $n$  that do not have two consecutive 0s. How many such bit strings are there of length 5?

0,1.

$$a_1 = 2$$

$$a_2 = 3$$

$\vdots$

$$a_{n-1} =$$

$a_n =$  no. of bit strings of length  $n$  not containing 00

0,1

01, 10, 11

$a_{n-1}$  1

$a_n =$  ...

1 0

$a_{n-2}$

$$a_n = a_{n-1} + a_{n-2}$$

$$a_1 = 2, a_2 = 3$$

2, 3, 5, 8, 13

$$a_5 =$$

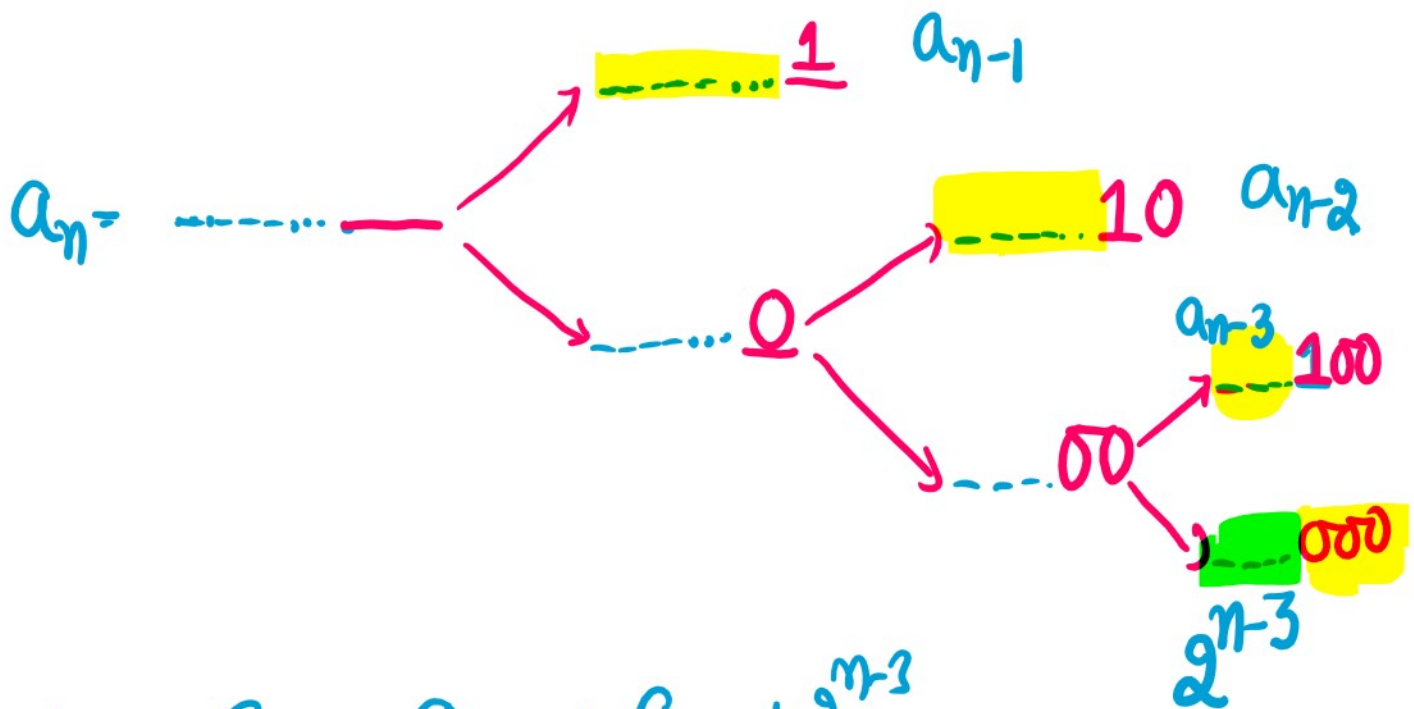
Q8. Find a recurrence relation for the number of bit strings of length  $n$  that contain three consecutive 0's?

... that

contain three consecutive 0's?

$a_n = \text{no. of bit strings of length } n \text{ that contain '000'}$

$$a_1 = 0, a_2 = 0, a_3 = 1 \dots a_{n-1}$$



$$a_n = a_{n-1} + a_{n-2} + a_{n-3} + 2^{n-3}$$

$$a_1 = 0, a_2 = 0, a_3 = 1$$

$$a_4 = a_3 + a_2 + a_1 + 2^1 = 0 + 0 + 1 + 2 = 3$$

$$a_5 = a_4 + a_3 + a_2 + 2^2 = 3 + 1 + 0 + 4 = 8$$

$$a_6 = a_5 + a_4 + a_3 + 2^3 = 8 + 3 + 1 + 8 = 20$$

Q9. A young pair of rabbits (one of each sex) is placed on an island. A pair of rabbits does not breed until they are 2 months old, each pair of rabbits produces another pair each month. Find the recurrence relation for the number of pairs of rabbits on the island after  $n$  months, assuming that no rabbit ever dies.

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$a_n =$  no. of rabbits' pairs after  $n$  months



$$a_n = a_{n-1} + a_{n-2}$$