2000 Paper 2 Question 5

Probability

An arbitrary value is loaded into an n-bit register. Let u_n be the probability that there are no instances of two (or more) adjacent bits being 0s.

A hardware designer suspects (correctly) that u_n is related to u_{n-1} and u_{n-2}. Write down the second-order difference equation which relates these terms.   [8 marks]

Justify the use of $u_0 = u_1 = 1$ as initial conditions.   [2 marks]

Solve the difference equation using these initial conditions.   [10 marks]