



3. Consider the following difference equation

$$a_{n+2} - 13a_{n+1} + 39a_n - 27a_{n-1} = (3^{n-1} - 2)(3^{n+1} + 2)$$

Find (again, the exact form of)

- (a) its general solution,
  - (b) the value of  $a_{12}$  given that  $a_0 = a_1 = a_2 = 0$ .
4. Consider a branching process where the number of offspring of each individual has the following distribution:

# of offspring:	0	1	2	3	4	5
Probability:	0.42	0.34	0.13	0.07	0.03	0.01

Assuming that the process starts with 15 individuals in Generation 0, compute (this time in decimal):

- (a) the expected number of ‘truncated’ progeny up to and including Generation 7, and the corresponding standard deviation,
  - (b) expected ‘time’ (in terms of generations) till extinction, and the corresponding standard deviation.
5. Consider a branching process where the number of offspring of each individual has the following distribution:

# of offspring:	0	1	2	3	4	5
Probability:	0.40	0.35	0.14	0.07	0.03	0.01

Assuming that the process starts with 15 individuals in Generation 0, compute the probability of

- (a) its ultimate extinction,
- (b) the 7<sup>th</sup> generation having between 12 and 25 members (inclusive).