CSL202: Discrete Mathematical Structures
Tutorial/Homework: 11

1. Solve the simultaneous recurrence relation:

$$\begin{aligned} a_n &= 3a_{n-1} + 2b_{n-1} \\ b_n &= a_{n-1} + 2b_{n-1} \end{aligned}$$

   with $a_0 = 1$ and $b_0 = 2$.

2. Solve the recurrence relation for Tower of Hanoi problem using generating function.

3. Solve Hat-check problem by formulating the recurrence relation for the number of derangements.

4. Let D_n denote the number of derangements of n objects. Show that $D_n = n \cdot D_{n-1} + (-1)^n$ for all $n \geq 2$.

5. How many relations are there on a set with n elements that are:

   (a) symmetric?
   (b) antisymmetric?
   (c) asymmetric?
   (d) irreflexive?
   (e) reflexive and symmetric?
   (f) neither reflexive nor irreflexive?

6. Let R be a symmetric relation. Show that R^n is symmetric for all positive integers n.