

## CS 111 ASSIGNMENT 3

**Problem 1:** a) Consider the following linear homogeneous recurrence relation:  $R_n = 4R_{n-1} - 3R_{n-2}$ . It is known that:  $R_0 = 1$ ,  $R_2 = 5$ . Find  $R_3$ .

b) Determine the general solution of the recurrence equation if its characteristic equation has the following roots: 1, -2, -2, 2, 7, 7.

c) Determine the general solution of the recurrence equation  $A_n = 256A_{n-4}$ .

d) Find the general form of the particular solution of the recurrence  $B_n = 3B_{n-2} - 2B_{n-3} + 2$ .

**Problem 2:** Solve the following recurrence equations:

a)

$$\begin{aligned}f_n &= f_{n-1} + 4f_{n-2} + 2f_{n-3} \\f_0 &= 0 \\f_1 &= 1 \\f_2 &= 4\end{aligned}$$

Show your work (all steps: the characteristic polynomial and its roots, the general solution, using the initial conditions to compute the final solution.)

b)

$$\begin{aligned}t_n &= t_{n-1} + 2t_{n-2} + 2^n \\t_0 &= 0 \\t_1 &= 2\end{aligned}$$

Show your work (all steps: the associated homogeneous equation, the characteristic polynomial and its roots, the general solution of the homogeneous equation, computing a particular solution, the general solution of the non-homogeneous equation, using the initial conditions to compute the final solution.)

**Problem 3:** We want to tile an  $n \times 1$  strip with  $1 \times 1$  tiles that are green (G), blue (B), and red (R),  $2 \times 1$  purple (P) and  $2 \times 1$  orange (O) tiles. Green, blue and purple tiles cannot be next to each other, and there should be no two purple or three blue or green tiles in a row (for ex., GGOBR is allowed, but GGGOBR, GROPP and PBOBR are not). Give a formula for the number of such tilings. Your solution must include a recurrence equation (with initial conditions!), and a full justification. You do not need to solve it.

**Academic integrity declaration.** The homework papers must include at the end an academic integrity declaration. This should be a brief paragraph where you state *in your own words* (1) whether you did the homework individually or in collaboration with a partner student (if so, provide the name), and (2) whether you used any external help or resources.

**Submission.** To submit the homework, you need to upload the pdf file to Gradescope. If you submit with a partner, you need to put two names on the assignment and submit it as a group assignment.