31 | Monte Carlo Simulation
• used to model random behavior → use runif(n)

EX.: Forecast over next 7 days has 50% chance of rain, prob of rain 3 consecutive days?

Transform:

$X \equiv$ the state on day $t = \begin{cases} 0 - \text{no rain} & t = 1, 2 \ldots 7 \\ 1 - \text{rain} \end{cases}$

Assumption:

$X_1, X_2, X_3 \ldots X_7$ are independent so that
$$P(X_t = 1 \mid X_{t-1}, X_{t-2}, \ldots) = P(X_t = 1) = .5$$

Obj: Det. if $X_t, X_{t-1}, X_{t-2} = 1$ for $t = 3, 4 \ldots 7$

$Y \equiv$ does week have 3 consecutive rain days
$Y \sim$ bernoulli(p) simulate to find p

$$\vec{X} = \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_7 \end{bmatrix} \quad y = \begin{cases} 0 & \text{ow} \\ 1 & X_1 * X_2 * X_3 + X_2 * X_3 * X_4 + X_3 * X_4 * X_5 + \\ & X_4 * X_5 * X_6 + X_5 * X_6 * X_7 \geq 1 \end{cases} \quad (1)$$

Solve:

$X_1 \ldots X_7 \rightarrow 0, 1$ depending on random #s runif()
$r \rightarrow 0, 1$ based on (1), run 100,000