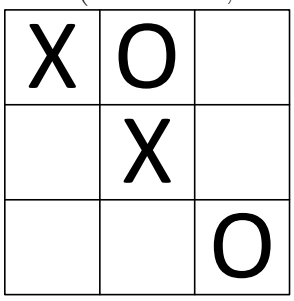
Homework 01

ECE 587, Spring 2026

Due Date: 02/15 (Sun.) by the end of the day (Chicago time)

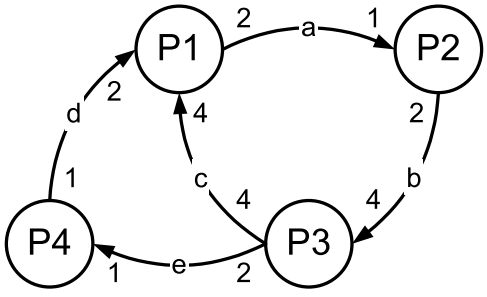
1. *(2 points)* The tic-tac-toe game, as shown below, uses a 3-by-3 board. Two players, X and O, take turns to fill an empty board until one of them wins by placing the same three in a row (horizontal, vertical, or diagonal).



   To build a FSM model for this game, we use the board itself as the state and the state transition happens when a player places an X or O in an empty box.

   1) How many states are there in the FSM model? What are the initial states and the final states? (Hint: First decide how many ways you could fill a single box. For simplicity you could count a state even if it cannot appear in a valid game, e.g. a board filled with all X.)
   2) What are the inputs? What is the next state function?

2. *(2 points)* Consider the computation specified by the following Synchronous Data Flow (SDF) model consisting of four processes `P1`,`P2`,`P3`,`P4` and five channels `a`,`b`,`c`,`d`,`e`.



   1) Determine the relative execution rates of the four processes.

2) Schedule the processes according to the rates computed in 1) (there are many possible schedules and you are free to pick any one). Compute the number of initial tokens required on each channel and the queue size of each channel according to your scheduling.

2. *(1 point)*

   Read the following sequential program that and model one loop iteration by a Data Flow Graph (DFG).

```
double a = ..., b = ..., c = ..., d = ...;
for (...) {
  double s=a+b;
  double t=a-b;
  a=s;
  b=t;
  s=c*d+a;
  t=c/d-b;
  c=s;
  d=t;
}
```