Math 5233: Markov chain worksheet

Group members (1 to 4): ______________________________________ Due 3/30

(1) In the standard betting ("pass the line") in the game of Craps, you begin in the "come-out" state. Each round you roll two 6-sided dice, and total the result. In the come-out state, if you roll a 2, 3, or 12, you lose. If you roll a 7 or 11, you win. Otherwise, the number you roll becomes the "point" number (4,5,6,8,9, or 10). Once the point number is set, you continue rolling until you either roll the point again, in which case you win, or you roll 7, in which case you lose.

If we use the ordered list of states $p = [\text{comeout}, \text{win}, \text{lose}, 4, 5, 6, 8, 9, 10]$, then we obtain a Markov chain with $p_{i+1} = p_i T$, where T is the transition matrix.

Complete the transition matrix below, and then draw the states and transitions as a graph. You do not have to label the edges with their weights, but do not include an edge if the transition value is zero.

$$T = \begin{pmatrix} 0 & \frac{2}{9} & \frac{1}{9} & \frac{1}{12} & \frac{1}{9} & \frac{5}{36} & \frac{5}{36} & \frac{1}{9} & \frac{1}{12} \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ & & & & & & & & \\ 0 & \frac{1}{12} & \frac{1}{6} & \frac{3}{4} & 0 & 0 & 0 & 0 & 0 \\ 0 & & & & & & & & \\ 0 & \frac{5}{36} & \frac{1}{6} & 0 & 0 & \frac{25}{36} & 0 & 0 & 0 \\ 0 & \frac{5}{36} & \frac{1}{6} & 0 & 0 & 0 & \frac{25}{36} & 0 & 0 \\ 0 & \frac{1}{9} & \frac{1}{6} & 0 & 0 & 0 & 0 & \frac{13}{18} & 0 \\ 0 & \frac{1}{12} & \frac{1}{6} & 0 & 0 & 0 & 0 & 0 & \frac{3}{4} \end{pmatrix}$$