

PROBLEM 11.1

11.1.A



$$P_{00} = 0^2 = \frac{2}{3} \frac{2}{3} = \boxed{\frac{4}{9}}, \quad P_{02} = \frac{5}{9}$$

$$P_{21} = \binom{2}{1} v(1-v) = 2 \frac{1}{3} \frac{2}{3} = \boxed{\frac{4}{9}}$$

$$P_{10} = v(1-0) = \frac{1}{3} \frac{1}{3} = \boxed{\frac{1}{9}}$$

$$P_{22} = \boxed{\frac{5}{9}}$$

$$P_{12} = \binom{2}{1} v 0 = 2 \frac{1}{3} \frac{2}{3} = \boxed{\frac{4}{9}}$$

$$\boxed{P_{11} = \frac{4}{9}}$$

	Q		
	0	1	2
0	4/9	0	5/9
1	1/9	4/9	4/9
2	0	4/9	5/9

	Q		
	2	1	0
2	5/9	4/9	0
1	4/9	4/9	1/9
0	5/9	0	4/9

11.1.B

$$\left| \begin{array}{cc|c} 1 & 0 & \\ 0 & 1 & \end{array} \right| - \left| \begin{array}{cc} 5/9 & 4/9 \\ 4/9 & 1/9 \end{array} \right| = \left| \begin{array}{cc} 4/9 & -4/9 \\ -4/9 & 5/9 \end{array} \right|$$

I - Q

$$C = \left| \begin{array}{cc} 4/9 & 4/9 \\ 4/9 & 5/9 \end{array} \right| \Rightarrow C^T = \left| \begin{array}{cc} 4/9 & 4/9 \\ 4/9 & 5/9 \end{array} \right|$$

$$CT \frac{1}{\det A} = \begin{vmatrix} 4/9 & 4/9 \\ 4/9 & 5/9 \end{vmatrix} \frac{1}{(4/9 \cdot 5/9 - (-4/9 \cdot -4/9))} = \begin{vmatrix} 4/9 & 4/9 \\ 4/9 & 5/9 \end{vmatrix} \frac{9}{1} = \frac{8}{4}$$

$$(I - Q)^{-1} = \begin{vmatrix} 1 & 1 \\ 1 & 5/4 \end{vmatrix} = N$$

11.1.C

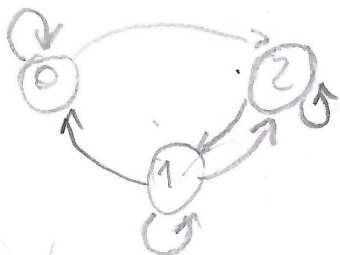
T : # consecutive slots that one node remains in backlogged

$$\begin{aligned} E[T] &= E[T_{11} + T_{21} + T_{22} + T_{12}] \\ &= E[T_{11}] + E[T_{21}] + E[T_{22}] + E[T_{12}] \\ &= 1 + 1 + 1 + \frac{5}{4} \\ &= \boxed{\frac{17}{4}} \end{aligned}$$

PROBLEM 11.2

11.2A

n, n_2 bac.



	0	1	2
0	3/9	0	4/9
1	1/9	4/9	4/9
2	0	8/27	19/27

$$n_2 \sigma \left(1 - \binom{2}{1} v \sigma (1-v) \right)$$

$$P_{02} = \sigma^2 = \frac{4}{9} \quad P_{00} = \frac{5}{9}$$

$$P_{10} = \frac{1}{9}, \quad P_{11} = \frac{4}{9}, \quad P_{12} = \frac{4}{9}$$

$$P_{21} = \binom{2}{1} v \sigma (1-v) = 2 \cdot \frac{1}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} = \frac{8}{27}$$

$$P_{22} = \frac{19}{27}$$

PROBLEM SAYS "CAN TRANSMIT" BECAUSE OF THAT
I am assuming P_{22}

11.2.B.

$$N = (I - Q)^{-1}$$

$$I - Q = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} - \begin{vmatrix} 5/9 & 0 \\ 1/9 & 4/9 \end{vmatrix} = \begin{vmatrix} 4/9 & 0 \\ -1/9 & 5/9 \end{vmatrix}$$

$$(I - Q)^{-1}$$

$$= \begin{vmatrix} 4/9 & 0 \\ -1/9 & 5/9 \end{vmatrix} \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} = \begin{vmatrix} 1 & 0 \\ 0 & 5/9 \end{vmatrix} \begin{vmatrix} 9/4 & 0 \\ 1/4 & 1 \end{vmatrix}$$

$$= \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix} \begin{vmatrix} 9/4 & 0 \\ 9/20 & 9/5 \end{vmatrix}$$

11.2.C

$$P(A) = NR = \begin{vmatrix} 9/4 & 0 \\ 9/20 & 9/5 \end{vmatrix} \begin{vmatrix} 4/9 \\ 4/9 \end{vmatrix} = \begin{vmatrix} 1 \\ 1 \end{vmatrix}$$