

# Midterm 1, Solutions

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$$1) P(3H|1st = T, 3rd = H) = \frac{\binom{3}{2} (1/2)^5}{2^3 (1/2)^5} = 3/8.$$

2)

$$P = \begin{pmatrix} 1 & 0 & 0 & 0 \\ .3 & 0 & .7 & 0 \\ 0 & .3 & 0 & .7 \\ 0 & 0 & 0 & 1 \end{pmatrix}.$$

3) a)

$$P = \begin{pmatrix} 2/3 & 1/3 & 0 \\ 2/3 & 0 & 1/3 \\ 0 & 0 & 1 \end{pmatrix}$$

b)  $n = 2, i = 0, j = 2$

c)  $(1/3)^2$

4) a) Let  $u_i = P(X_T = 2 | X_0 = i)$ . Then  $u_0, u_3 = 0$  and  $u_2 = 1$ . Also  $u_1 = .3u_1 + .5$ . Solving we get that  $u_1 = 5/7$ .

b) The answer is 0 since starting in state one the MC cannot end up in state three.

5) Let  $V$  denote the expected earnings. Then  $V = (1/3)(4 + V) + (1/2)(6 + V)$ . Solving this equation we get that  $V = 45/3$ .