

Problem 1

$$Q_1(A, 1) = T(A, 1, A)[R(A, 1, A) + V_0(A)] + T(A, 1, B)[R(A, 1, B) + V_0(B)] = 0 * 0 + 1 * 0 = 0$$

$$Q_1(A, 2) = T(A, 2, A)[R(A, 2, A) + V_0(A)] + T(A, 2, B)[R(A, 2, B) + V_0(B)] = 1 * 2 + 0 * 0 = 2$$

$$Q_1(A, 3) = T(A, 3, A)[R(A, 3, A) + V_0(A)] + T(A, 3, B)[R(A, 3, B) + V_0(B)] = 0.5 * 0 + 0.5 * 0 = 1$$

$$Q_1(B, 1) = T(B, 1, A)[R(B, 1, A) + V_0(A)] + T(B, 1, B)[R(B, 1, B) + V_0(B)] = 0.5 * 12 + 0.5 * 0 = 6$$

$$Q_1(B, 2) = T(B, 2, A)[R(B, 2, A) + V_0(A)] + T(B, 2, B)[R(B, 2, B) + V_0(B)] = 1 * 0 + 0 * 0 = 0$$

$$Q_1(B, 3) = T(B, 3, A)[R(B, 3, A) + V_0(A)] + T(B, 3, B)[R(B, 3, B) + V_0(B)] = 0.5 * 2 + 0.5 * 4 = 3$$

$$V_1(A) = 2$$

$$V_1(B) = 6$$

$$Q_2(A, 1) = T(A, 1, A)[R(A, 1, A) + V_1(A)] + T(A, 1, B)[R(A, 1, B) + V_1(B)] = 0 * 2 + 1 * 6 = 0$$

$$Q_2(A, 2) = T(A, 2, A)[R(A, 2, A) + V_1(A)] + T(A, 2, B)[R(A, 2, B) + V_1(B)] = 1 * 4 + 0 * 6 = 2$$

$$Q_2(A, 3) = T(A, 3, A)[R(A, 3, A) + V_1(A)] + T(A, 3, B)[R(A, 3, B) + V_1(B)] = 0.5 * 2 + 0.5 * 6 = 1$$

$$Q_2(B, 1) = T(B, 1, A)[R(B, 1, A) + V_1(A)] + T(B, 1, B)[R(B, 1, B) + V_1(B)] = 0.5 * 14 + 0.5 * 6 = 10$$

$$Q_2(B, 2) = T(B, 2, A)[R(B, 2, A) + V_1(A)] + T(B, 2, B)[R(B, 2, B) + V_1(B)] = 1 * 2 + 0 * 6 = 2$$

$$Q_2(B, 3) = T(B, 3, A)[R(B, 3, A) + V_1(A)] + T(B, 3, B)[R(B, 3, B) + V_1(B)] = 0.5 * 4 + 0.5 * 10 = 7$$

$$V_2(A) = 2$$

$$V_2(B) = 10$$

$$\pi_1(A) = 2$$

$$\pi_1(B) = 1$$

$$\pi_2(A) = 2$$

$$\pi_2(B) = 1$$

Problem 2

$$Q(0,1) = R(0,1) + \gamma * \max(Q(1,2), Q(1,0)) = 0 + 0.5 * \max(8,4) = 4$$

$$Q(1,2) = R(1,2) + \gamma * \max(Q(2,3), Q(2,5)) = 0 + 0.5 * \max(16,4) = 8$$

$$Q(2,5) = R(2,5) + \gamma * \max(Q(5,4), Q(5,2)) = 0 + \max(10,8) = 5$$

$$Q(5,4) = R(5,4) + \gamma * \max(Q(4,3)) = 0 + \max(20) = 10$$

$$Q(4,3) = R(4,3) = 20$$

Problem 3

Part 1

$$\Pr(A) = (0.5)(0.8) + (0.5)(0.6) = 0.7$$

$$\Pr(B) = (0.5)(0.2) + (0.5)(0.4) = 0.3$$

Part 2

$$[\pi_A \quad \pi_B] \begin{bmatrix} 0.8 & 0.2 \\ 0.6 & 0.4 \end{bmatrix} = [\pi_A \quad \pi_B]$$

$$0.8\pi_A + 0.6\pi_B = \pi_A$$

$$0.2\pi_A + 0.4\pi_B = \pi_B$$

$$\pi_A + \pi_B = 1$$

$$\pi_A = 0.75$$

$$\pi_B = 0.25$$

Problem 4

Part 1

$$P(Y = 1|X_1 = 1, X_2 = 1) = P(Y)P(X_1|Y)P(X_2|Y) = p_1p_2q$$

Part 2

$$p_1 = 0.6$$

$$p_2 = 0.7$$

$$q = 0.3$$

Problem 5

i	w_i
0	$\langle 0, 0 \rangle$
1	$\langle 1, 0 \rangle$
2	$\langle 1, 0 \rangle$
3	$\langle 1, -1 \rangle$
4	$\langle 0, -2 \rangle$
5	$\langle 0, -2 \rangle$