Vicky Zhao

1. Q1   (a), (c), (e) (h)

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Q2
$$V_\pi(y) \doteq E_\pi[G_t | S_t = y]$$
$$= E_\pi[R_{t+1} + \gamma G_{t+1} | S_t = y]$$
$$= E_\pi[R_{t+1} | S_t = y] + \gamma E_\pi[G_{t+1} | S_t = y] \quad (LE)$$
$$= g_\pi(y) + \gamma E_\pi[E_\pi[G_{t+1} | S_{t+1}, S_t = y] | S_t = y]$$
$$\qquad\qquad\qquad\qquad\qquad\qquad (LOTE)$$

$$= g_\pi(y) + \gamma E_\pi[E_\pi[G_{t+1} | S_{t+1}] | S_t = y] \quad (MP)$$

$$= g_\pi(y) + \gamma E_\pi[V_\pi(S_{t+1}) | S_t = y]$$

$$= g_\pi(y) + \gamma \sum_{y'} P_\pi(S_{t+1} = y' | S_t = y) \sum_b \pi(b|y') g_\pi(y', b) \quad \forall y, \forall b$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (LOTUS)$$

Q3

$$G_1 = R_2 + \gamma G_2 \qquad G_0 = R_1 + \gamma G_1$$

$$G_4 = \frac{5}{1-\gamma} = \frac{5}{1-0.9} = \frac{5}{0.1} = 50$$

$$G_3 = R_4 + \gamma G_4 \qquad G_3 = 5 + 0.9 \times 50 = 5 + 45 = 50$$

$$G_2 = R_3 + \gamma G_3 \qquad G_2 = 0 + 0.9 \times 50 = 45$$

$$G_1 = R_2 + \gamma G_2 \qquad G_1 = -2 + 0.9 \times 45 = 38.5$$

$$G_0 = R_1 + \gamma G_1 = 2 + 0.9 \times 38.5 = 36.65$$

$$\therefore G_1 = 38.5 \quad , \quad G_0 = 36.65$$

Q4

A. $q_z(11, down)$

$= -1 + 0.99 \times 0 \qquad = -1$

B. $q_z(7, down)$

$= -1 + 0.99 \times -14 = -14.86$

C. $q_z(13, up)$

$= -1 + 0.99 \times -20 = -20.8$