5 (a)

Figure 4.1 depicts all v_k for the random policy

$$q_\pi(11, \text{down}) = \underbrace{R(11, \text{down}, \text{shade})}_{\to -1} + \underbrace{V^\pi(\text{shade})}_{\to 0}$$

$$= -1$$

$$q_\pi(7, \text{down}) = \underbrace{R(7, \text{down}, 11)}_{\to -1} + \underbrace{V^\pi(11)}_{\to -14}$$

$$= -15$$

(b) $$v_\pi(s) = R_\pi(s) + \sum_{s'} \frac{1}{4} v^\pi(s')$$

$$= -1 + \frac{1}{4}\{-20 - 22 - 14 + v_\pi(15)\}$$

$$= -15 + \frac{v_\pi(15)}{4}$$

$$v_\pi(15)\,\frac{3}{4} = -15$$

$$v_\pi(15) = -20$$

Setting S' to $S=15$ is exactly the same state, $S=13$.

This means nothing is changed, thus $v_\pi(15) = -20$