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Exercise 3x3

Step 1

$$1.) v_{k+1}(A) = \frac{1}{4}(-1 + v(A)) + (-1 + v(B)) + (-1 + v(D)) + (-1 + v(A))$$

$$v_{k+1}(A) = \frac{1}{4}(-1+0) + (-1+0) + (-1+0) + (-1+0)$$

$$v_{k+1}(A) = -1,$$

$$2.) v_{k+1}(B) = \frac{1}{4}(-1 + v(A)) + (-1 + v(C)) + (-1 + v(E)) + (-1 + v(B))$$

$$v_{k+1}(B) = \frac{1}{4}(-1+0) + (-1+0) + (-1+0) + (-1+0)$$

$$v_{k+1}(B) = -1,$$

$$3.) v_{k+1}(D) = \frac{1}{4}(-1 + v(D)) + (-1 + v(E)) + (-1 + v(G)) + (-1 + v(A))$$

$$v_{k+1}(D) = \frac{1}{4}(-1+0) + (-1+0) + (-1+0) + (-1+0)$$

$$v_{k+1}(D) = -1,$$

$$4.) v_{k+1}(E) = \frac{1}{4}(-1 + v(B)) + (-1 + v(F)) + (-1 + v(H)) + (-1 + v(B))$$

$$v_{k+1}(E) = \frac{1}{4}(-1+0) + (-1+0) + (-1+0) + (-1+0)$$

$$v_{k+1}(E) = -1,$$

$$5.) v_{k+1}(F) = \frac{1}{4}(-1 + v(E)) + (-1 + v(F)) + (-1 + v(\#)) + (-1 + v(C))$$

$$v_{k+1}(F) = \frac{1}{4}(-1+0) + (-1+0) + (-1+0) + (-1+0) = -1,$$

$$6.) v_{k+1}(H) = \frac{1}{4}(-1 + v(E)) + (-1 + v(I)) + (-1 + v(E)) + (-1 + v(F))$$

$$v_{k+1}(H) = \frac{1}{4}(-1+0) + (-1+0) + (-1+0) + (-1+0) = -1,$$

7)	-1	-1	0
	-1	-1	-1
	0	-1	0

Step 2

$$8.) q_{k+1}(A, \text{Left}) = -1 + (-1) = -2,$$

$$9.) q_{k+1}(A, \text{Right}) = -1 + (-1) = -2,$$

$$10.) q_{k+1}(A, \text{Up}) = -1 + (-1) = -2,$$

$$11.) q_{k+1}(A, \text{Down}) = -1 + (-1) = -2,$$

$$12.) \pi_{k+1}(A) = \{\text{Left, Right, Up, Down}\}$$

$$13.) q_{k+1}(B, \text{Left}) = -1 + (-1) = -2,$$

$$14.) q_{k+1}(B, \text{Right}) = -1 + 0 = -1$$

$$15.) q_{k+1}(B, \text{Up}) = -1 + (-1) = -2,$$

$$16.) q_{k+1}(B, \text{Down}) = -1 + (-1) = -2,$$

$$17.) \pi_{k+1}(B) = \{\text{Right}\}$$

18.)  $q_{k+1}(D, \text{Left}) = -1 + (-1) = -2$ ,

19.)  $q_{k+1}(D, \text{Right}) = -1 + (-1) = -2$ ,

20.)  $q_{k+1}(D, \text{Up}) = -1 + (-1) = -2$ ,

21.)  $q_{k+1}(D, \text{Down}) = -1 + 0 = -1$ ,

22.)  $\pi_{k+1}(D) = \{\text{Down}\}$ ,

23.)  $q_{k+1}(E, \text{Left}) = -1 + (-1) = -2$ ,

24.)  $q_{k+1}(E, \text{Right}) = -1 + (-1) = -2$ ,

25.)  $q_{k+1}(E, \text{Up}) = -1 + (-1) = -2$ ,

26.)  $q_{k+1}(E, \text{Down}) = -1 + (-1) = -2$ ,

27.)  $\pi_{k+1}(E) = \{\text{Left, Right, Up, Down}\}$ ,

28.)  $q_{k+1}(F, \text{Left}) = -1 + (-1) = -2$ ,

29.)  $q_{k+1}(F, \text{Right}) = -1 + (-1) = -2$ ,

30.)  $q_{k+1}(F, \text{Up}) = -1 + 0 = -1$ ,

31.)  $q_{k+1}(F, \text{Down}) = -1 + 0 = -1$ ,

32.)  $\pi_{k+1}(F) = \{\text{Up, Down}\}$ ,

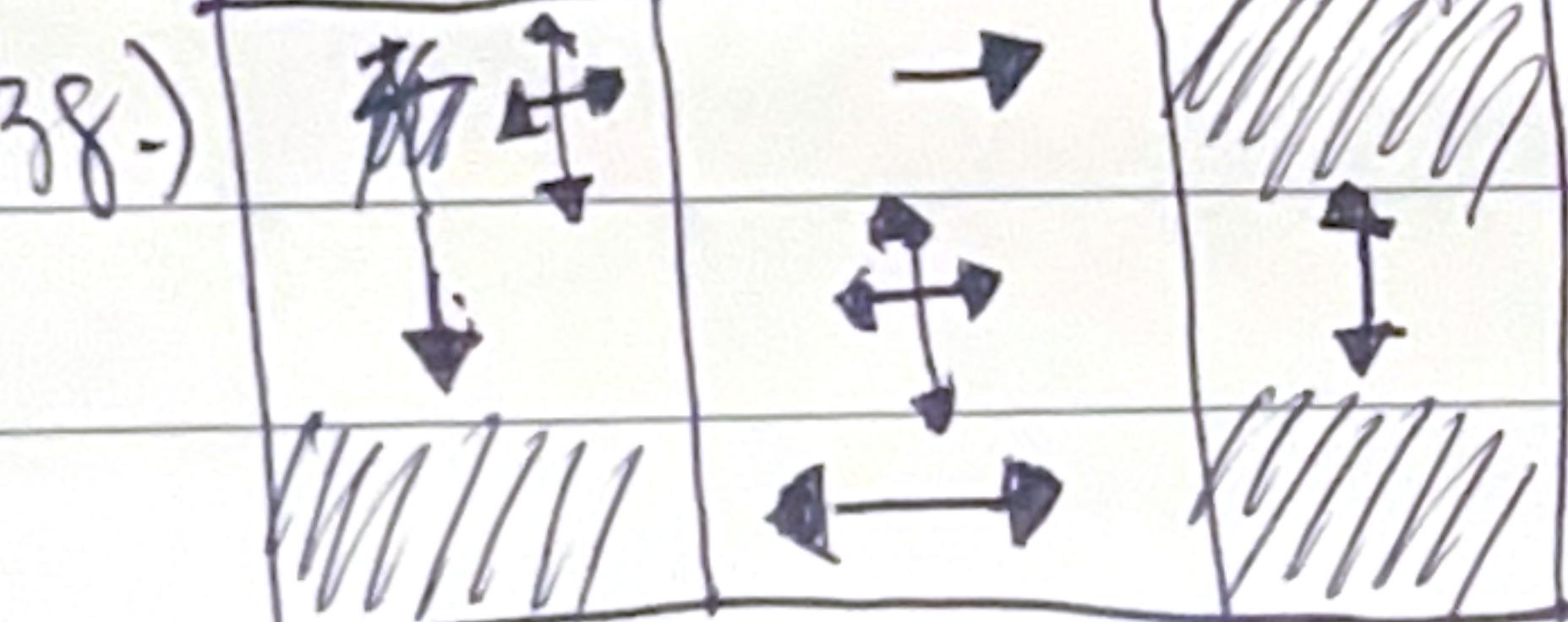
33.)  $q_{k+1}(\text{H, Left}) = -1 + 0 = -1$ ,

34.)  $q_{k+1}(\text{H, Right}) = -1 + 0 = -1$ ,

35.)  $q_{k+1}(\text{H, Up}) = -1 + (-1) = -2$ ,

36.)  $q_{k+1}(\text{H, Down}) = -1 + (-1) = -2$ ,

37.)  $\pi_{k+1}(\text{H}) = \{\text{Left, Right}\}$ ,



38.) Step 3

$$39.) V_*(A) = \frac{1}{4}(-1 + v_*(A)) + (-1 + v_*(B)) + (1 + v_*(D)) + (-1 + v_*(F)) \\ = \frac{1}{4}(-1 + -1) + (-1 + -1) + (-1 + -1) + (-1 + -1) = -2$$

$$40.) V_*(B) = \frac{1}{4}(-1 + v_*(A)) + (-1 + v_*(C)) + (1 + v_*(E)) + (-1 + v_*(B)) \\ = \frac{1}{4}(-1 + -1) + (-1 + -1) + (-1 + -1) + (-1 + -1) = -1.75$$

$$41.) V_*(D) = \frac{1}{4}(-1 + v_*(D)) + (-1 + v_*(E)) + (-1 + v_*(G)) + (-1 + v_*(A)) \\ = \frac{1}{4}(-1 + -1) + (-1 + -1) + (-1 + 0) + (-1 + -1) = -1.75$$

$$42.) V_*(E) = \frac{1}{4}(-1 + -1) + (-1 + -1) + (-1 + -1) + (-1 + -1) = -2$$

$$43.) V_*(F) = \frac{1}{4}(-1 + -1) + (-1 + -1) + (-1 + 6) + (-1 + 0) = -1.5$$

$$44.) V_*(H) = \frac{1}{4}(-1 + 0) + (-1 + 0) + (-1 + -1) + (-1 + -1) = 1.5$$

$A = -2$	$B = 1.5$	$C = 0$
$D = 1.75$	$E = -2$	$F = 1.5$
$G = 0$	$H = 1.5$	$I = 0$

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$$A_{\text{Left}} = -1 + (-2) = -3, \quad A_{\text{Right}} = -1 + (-1.75) = -2.75, \\ A_{\text{Down}} = -1 + (-1.75) = -2.75, \quad A_{\text{Up}} = -1 + (-2) = -3,$$

$$4(b) A * (B \setminus A) = B, \text{Left} = -1 + (-2) = -3, \quad B, \text{Right} = -1 + (0) = -1, \\ B, \text{Down} = -1 + (-2) = -3, \quad B, \text{Up} = -1 + (175) = 2.75.$$

$$47.) \text{Q} * (\gamma | A) = B, \text{Left} = -1 + (-1 \cdot 75) = -2.75, \text{P, Right} = 1 + (-2) = -3, \\ \text{D, Down} = -1 + 0 = -1, \text{P, Up} = -1 + (-2) = -3,$$

$$48) \text{A}_{1,1}(E|A) = E_{\text{left}} = -1 + (-1 \cdot 75) = -2.75, E_{\text{right}} = -1 + (1 \cdot 5) = -2.5, \\ E_{\text{down}} = -1 + (-1 \cdot 5) = -2.5, E_{\text{up}} = -1 + (-1 \cdot 75) = -2.75$$

$$49 \rightarrow q_{\text{FK}}(FKA) = F, L_{\text{left}} = -1 + (-2) = -3, F_{\text{Right}} = -1 + (2) = -3, \\ F_{\text{Down}} = 1 + 0 = -1, F_{\text{Up}} = -1 + 0 = -1,$$

$$\text{So, } q_k(\text{HIV}) = H, L-H = -1+0 = -1, \quad H, \text{Right} = -1+0 = -1$$

$$H, \text{Down} = -1+1.5 = -2.5, \quad H, V_p = -1+(-2) = -3$$

$$S1.) \mathcal{P}_*(A) = \{ \text{Right}, \text{Down} \}$$

$$(2.) \pi_+(B) = \{\text{Right}\}$$

$$53 \rightarrow \pi_*(D) = \{D_{0n}\}$$

$$\pi^*_{\mathcal{F}}(\mathcal{E}) = \{\text{Right}, \text{Down}\}$$

$$55. \quad \mathcal{D}_*(F) = \{\text{Down}_n, \text{Up}\}$$

$\text{sk}(\mathcal{T}_*(H)) = \{\text{left}, \text{right}\}$

54.) Put the optimal value functions in the  $3 \times 3$  grid:

-2	-1.75	0
-1.75	-2	-1.5
0	-1.5	0

58.) Put the optimal policy in the  $3 \times 3$  grid

