

Homework 5*Handed Out: April 5**Due: April 19, 7:59 p.m.*

- **Your Name:** *Qihang Dai*
- **Your PennKey:** *ahgdyycc*
- **Your PennID:** *78803164*

1 Multiple Choice & Written Questions

1. (a) bob loves cookie

$$\begin{aligned} \text{(b)} \quad \ln P(w_1 = \text{loves}, w_2 = \text{cookie} | w_0 = \text{bob}) &= \ln P(w_1 = \text{loves} | w_0 = \text{bob}) + \\ &\ln P(w_2 = \text{cookie} | w_1 = \text{loves}, w_0 = \text{bob}) = \ln 0.5 + \ln 0.4 = \ln 0.2 = \\ \ln P(w_1 = \text{hates}, w_2 = \text{cookie} | w_0 = \text{bob}) &= \ln P(w_1 = \text{hates} | w_0 = \text{bob}) + \\ \ln P(w_2 = \text{cookie} | w_1 = \text{hates}, w_0 = \text{bob}) &= \ln 0.4 + \ln 0.2 = \ln 0.08 \end{aligned}$$

(c) no. greedy sampling may be the best for the first word, but it is not the best for the second word. And the combination of this two gram may not be the highest probability among the 2-gram model.

$$\begin{aligned} \text{(d)} \quad \ln P(w_1 = \text{loves}, w_2 = \text{Bob} | w_0 = \text{Bob}) &= \ln P(w_1 = \text{loves} | w_0 = \text{Bob}) + \\ \ln P(w_2 = \text{Bob} | w_1 = \text{loves}, w_0 = \text{Bob}) &= \ln 0.5 + \ln 0.25 = \ln 0.125 \\ \ln P(w_1 = \text{hates}, w_2 = \text{cherry} | w_0 = \text{Bob}) &= \ln P(w_1 = \text{hates} | w_0 = \text{Bob}) + \\ \ln P(w_2 = \text{cherry} | w_1 = \text{hates}, w_0 = \text{Bob}) &= \ln 0.4 + \ln 0.7 = \ln 0.28 \end{aligned}$$

Compared with answer calculated in (a), we should keep the two sentence with higher probability. So the answer is "Bob loves cherry" and "Bob loves cookie".

2. (a)

[0.520.370.310.16]

(b)

[0.2970.2550.2410.207]

(c)

[0.27960.40320.2620.3138]

3. (a)

| State s | Condition | i | Vi(s) |
|---------|-----------------|---|-------|
| P | $V(P) > 0$ | 2 | 75 |
| Q | $V(Q) > 0$ | 2 | 30 |
| P | $V(P) = V^*(P)$ | 2 | 75 |
| Q | $V(Q) = V^*(Q)$ | 5 | 75 |

(b)

| State s | Condition | i | Vi(s) |
|---------|-----------------|---|-------|
| P | $V(P) = V^*(P)$ | 2 | 48 |

Diagram illustrating the evolution of a 2D lattice over time steps 0, 1, 2, 3, 4, and 5. The lattice is represented by a grid of cells, with the top row showing the values of P , V , and Q at each time step, and the bottom row showing the values of P , V , and Q at the next time step. The cells are colored red or white, indicating the state of the lattice.

- Time Step 0:** $P=0$, $V=0$, $Q=0$. The bottom row shows $P=+75$, $V=0$, $Q=+30$.
- Time Step 1:** $P=75$, $V=75$, $Q=30$. The bottom row shows $P=+75$, $V=75$, $Q=+30$.
- Time Step 2:** $P=75$, $V=75$, $Q=30$. The bottom row shows $P=+75$, $V=75$, $Q=+30$.
- Time Step 3:** $P=75$, $V=75$, $Q=30$. The bottom row shows $P=+75$, $V=75$, $Q=+30$.
- Time Step 4:** $P=75$, $V=75$, $Q=30$. The bottom row shows $P=+75$, $V=75$, $Q=+30$.
- Time Step 5:** $P=75$, $V=75$, $Q=30$. The bottom row shows $P=+75$, $V=75$, $Q=+30$.

Figure 1: (a) The value iteration process

| | | | |
|-----|----|---|-----|
| P0 | 0 | 0 | Q0 |
| 0 | V0 | | 0 |
| +75 | | | +30 |

| | | | |
|-----|----|--|-----|
| P | | | Q |
| 60 | V1 | | 24 |
| +75 | | | +30 |

| | | | |
|------|----|--|--------|
| P 48 | | | Q 19.2 |
| 60 | V2 | | 24 |
| +75 | | | +30 |

Figure 2: (b) The stochastic value iteration process

4. (a) see figures below
- (b) $V^* = 6.4$
- (c) $\text{grid}[\text{row2}, \text{col3}] = 8$, $\text{grid}[\text{row1}, \text{col3}] = 10$

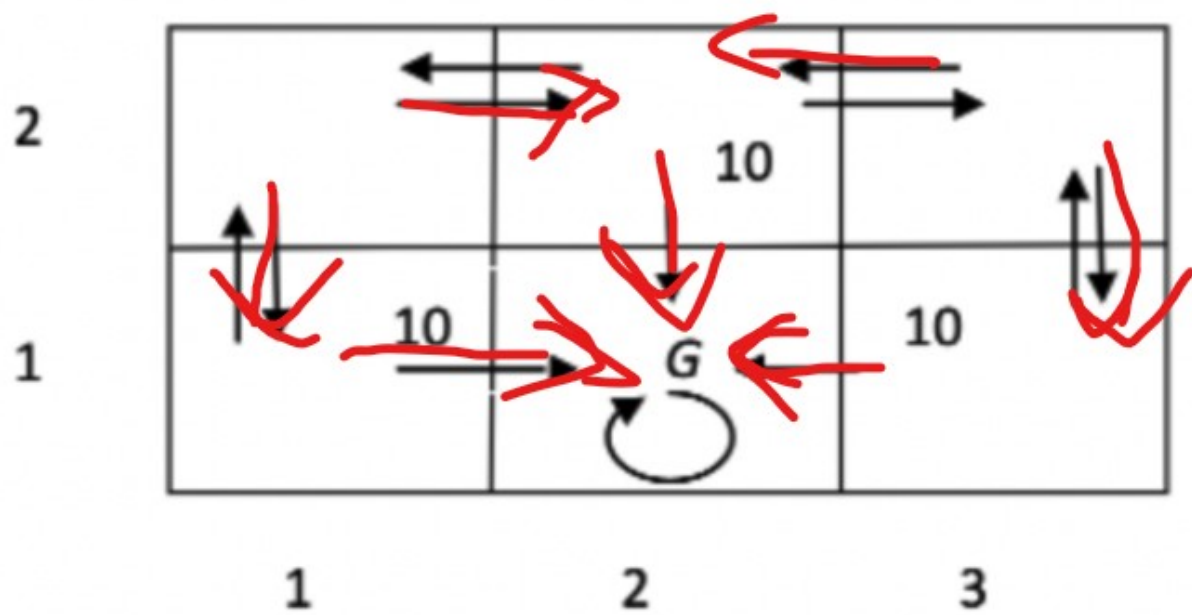


Figure 3: (a) The optimal action