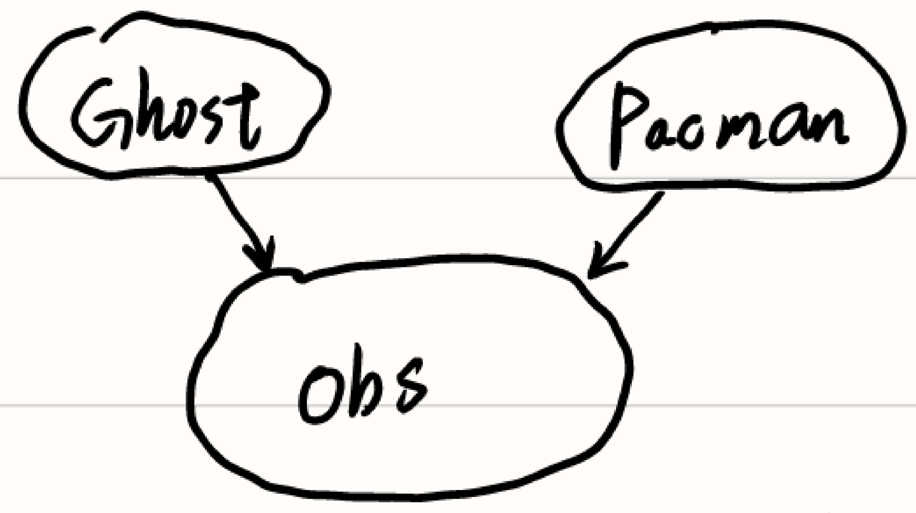
23210980044 加兴华 PJ 2

Part 1:

Q1



假设Ghost1与Ghost2相互独立，则问题形式可简化如上。

此时cpt为 $P(obs \mid Pacman, Ghost)$

由于 $obs = \max\{1, |Pacman - Ghost| + v\}$ v s.t. $P(v) = \begin{cases} \frac{2^{7-|v|}}{382}, & v \in [-7, 7] \\ 0, & \text{otherwise} \end{cases}$

cpt:

obs	$d = \|Pacman - Ghost\|$	$P(obs \mid Ghost, Pacman)$
$[2, +\infty)$	$[1, +\infty)$	$P(v = obs - d)$
1	$[1, 8]$	$\sum_{i=-7}^{1-d} P(v=i)$

$P(d + v \le 1) = P(v \le 1 - d)$

Q2

1. $P(obs = 6 \mid Pacman = 5, Ghost = 12)$

$= P(obs = 6 - 7)$

$= P(v = -1) = \frac{2^6}{382}$

2. $P(obs1 = 9, obs2 = 1 \mid Pacman = 5, Ghost1 = 12, Ghost2 = 4)$

$= P(obs = 9 \mid G = 12, P = 5) \cdot P(obs = 1 \mid G = 4, P = 5)$ $\because Ghost1 \perp\!\!\!\perp Ghost2$

$= P(v = 2) \cdot \sum_{i=-7}^{0} P(v = i)$

$= \frac{2^5}{382} \cdot \frac{2^8 - 1}{382}$

3. $P(\text{Ghost}=3 \mid \text{Pacman}=4, \text{obs}=1)$

$$= \frac{P(\text{obs}=1 \mid G=3, P=4) \cdot P(G=3, P=4)}{\sum P(\text{obs}=1 \mid G, P=4) \cdot P(G, P=4)}$$

由于均匀初始化 $\therefore P(G, P=4) = P(G=3, P=4)$

$$= \frac{\sum_{i=-7}^{1} P(v=i)}{2 \cdot \sum_{d=1}^{8} \sum_{i=-7}^{1-d} P(v=i)}$$

$$= \frac{1}{2} \cdot \frac{2^8 - 1}{(2^1-1)+(2^2-1)+\cdots(2^8-1)}$$

$$= \frac{2^8-1}{2 \cdot 502}$$

4. $P(\text{Ghost1}=3 \mid \text{Pacman}=4, \text{obs1}=8, \text{obs2}=2)$

$$= P(\text{Ghost1}=3 \mid \text{Pacman}=4, \text{obs1}=8).$$

$$= \frac{P(\text{obs}=8 \mid G=3, P=4)\, P(G=3, P=4)}{\sum_G P(\text{obs}=8 \mid G, P=4)\, P(G, P=4)}$$

$$= \frac{P'(v=7)}{2 \cdot \sum_{d=1}^{\infty} P'(v=8-d)} = 2 \cdot 1$$

$$= \frac{1}{2} \cdot \frac{1}{382} = \frac{1}{764}$$

5. $P(\text{Ghost1} = \text{Ghost2} = 3 \mid \text{Pacman}=4, \text{obs1}=8, \text{obs2}=2)$

$$= P(\text{Ghost1}=3 \mid \text{Pacman}=4, \text{obs1}=8) \cdot P(\text{Ghost2}=3 \mid \text{Pacman}=4, \text{obs2}=2)$$

$$= \frac{1}{764} \cdot P(G=3 \mid P=4, \text{obs}=2)$$

$$= \frac{1}{764} \cdot \frac{1}{2} \cdot \frac{P(v=1)}{\sum_{d=1}^{+\infty} P(v=2-d)} = 2^0 + \cdots 2^7 + 2^6 = 2^8 + 2^6 - 1 = 319$$

$$= \frac{1}{764} \cdot \frac{2^6}{319}$$

Part 2

step 1：思路为 各坐标当前概率 $\propto$ 历史概率 $\times$ 当前观测的概率

step 2：思路为
- $P(x) = \sum P(y) \cdot$ 转移概率$(y \to x)$
- 编程上
  - 初始化全0的 $belief^{new}$
  - 遍历 y，对可转移到的 x 执行 $belief^{new}(x) \mathrel{+}= P(y) \cdot P(y \to x)$，最后归一

step 3：思路为
- 首先遍历所有存活幽灵，找到最可能存在幽灵的位置
- 计算 Pacman 所有后继动作与最可能位置的距离
- 取让距离最小的动作

Part 3.

step 1：思路为 按合法位置平铺粒子，当粒子足够多，每个位置的粒子数是接近均匀的.

step 2：思路为
- 首先取得 pacman 及 jail 位置
- 遍历粒子，假设当前粒子处有 Ghost，Belief(该处) += 观测概率
- sum(belief) = 0
  - yes. 重新初始化
  - no. 归一化并按用 sample 方法更新粒子位置

step3：思路为
- 对每个粒子获得其新位置分布
- 按分布采样作为其新位置

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Finished at 22:06:49

Provisional grades
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Question q2-1: 3/3
Question q2-2: 3/3
Question q2-3: 2/2
Question q3-1: 2/2
Question q3-2: 3/3
Question q3-3: 3/3
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Total: 16/16

Your grades are NOT yet registered.  To register your grades, make sure
to follow your instructor's guidelines to receive credit on your project.

(dm) (base) jxh@dbcloud:/home/newdisk/jxh/课程项目/人工智能/PJ2/code$
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