1. a. F

$$P(E_1 | E_2) = \frac{P(E_1 \cap E_2)}{P(E_2)}$$

$$P(A \cap B | C) = \frac{P(A \cap B \cap C)}{P(C)}$$

$$F = \frac{P(A \cap B \cap C)}{P(B \cap C)} \cdot \frac{\cancel{P}(B \cap C)}{P(C)}$$

$$\frac{P(A \cap C)\ P(B \cap C)}{P(C)}$$

$$A: \frac{\frac{P(C \cap A)}{P(A)} \cdot \frac{P(A \cap B)}{\cancel{P(B)}} \cdot \cancel{P(B)}}{P(C)} = \frac{P(C \cap A) \cdot P(A \cap B)}{P(A) \cdot P(C)} \quad \times$$

$$B: \frac{\frac{P(B \cap C \cap A)}{\cancel{P(A)}} \cdot \cancel{P(A)}}{P(B \cap C)} \quad \times$$

$$C: \frac{\frac{P(A \cap C)}{P(C)} \cdot \frac{P(\cancel{C} \cap B)}{\cancel{P(B)}} \cdot \cancel{P(B)}}{\cancel{P(B \cap C)}} \quad \times$$

$$D: \frac{\frac{P(A \cap C)}{P(C)} \cdot P(B \cap C)}{P(C)} \quad \times$$

$$E: \frac{\frac{P(C \cap A \cap B)}{P(A \cap B)} \cdot \frac{P(B \cap A)}{\cancel{P(A)}} \cdot \cancel{P(A)}}{\frac{P(B \cap C)}{\cancel{P(C)}} \cdot \cancel{P(C)}} \quad \times$$

1. b. B, E

$$P(A \mid B\cap C) = \frac{P(A\cap B\cap C)}{P(B\cap C)}$$

A: $$\frac{\frac{P(C\cap A)}{P(A)} \cdot \frac{P(A\cap B)}{\cancel{P(B)}} \cdot \cancel{P(B)}}{P(B\cap C)}$$ ✗

B: $$\frac{\frac{P(B\cap C\cap A)}{\cancel{P(A)}} \cdot \cancel{P(A)}}{P(B\cap C)}$$ ✓

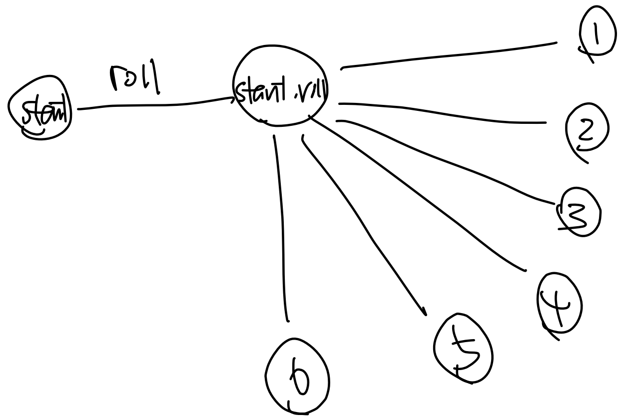
C: $$\frac{\frac{P(A\cap C)}{P(C)} \cdot \frac{P(C\cap B)}{\cancel{P(B)}} \cdot \cancel{P(B)}}{P(B\cap C)}$$ ✗

D: $$\frac{\frac{P(A\cap C)}{P(C)} \cdot P(B\cap C)}{P(C)}$$ ✗

E: $$\frac{\frac{P(C\cap A\cap B)}{\cancel{P(A\cap B)}} \cdot \frac{\cancel{P(B\cap A)}}{\cancel{P(A)}} \cdot \cancel{P(A)}}{\frac{P(B\cap C)}{\cancel{P(C)}} \cdot \cancel{P(C)}}$$ ✓

F: $$\frac{P(A\cap B\cap C)}{\cancel{P(B\cap C)}} \cdot \frac{\cancel{P(B\cap C)}}{P(C)}$$ ✗

2.a.



$$\frac{1}{6}\sum_{j} V^{h}(j) = \frac{1}{6}(1+2+3+4+5+6) = 3.5$$

$$V^{h-1}(1) = \max\{3.5, 1\} = 3.5$$

$$V^{h-1}(2) = \max\{3.5, 2\} = 3.5$$

$$V^{h-1}(3) = \max\{3.5, 3\} = 3.5$$

$$V^{h-1}(4) = \max\{3.5, 4\} = 4$$

$$V^{h-1}(5) = \max\{3.5, 5\} = 5$$

$$V^{h-1}(6) = \max\{3.5, 6\} = 6$$

b.
$$V^{k-1}(i) = \max(Q^{k-1}(i, \text{roll}), Q^{k-1}(i, \text{stop})) = \max\left(\frac{1}{6}\sum_{j} V^{k}(j), i\right)$$

c. $q(h-1) = Q^{h-1}(\text{state}, \text{"Roll"}) = \frac{1}{6}\sum_{j} V^{k}_{(j)} = \frac{1}{6}(1+2+3+4+5+6) = 3.5$

d. $q(k-1) = \frac{1}{6}\sum_{j} V^{k}(j) = \frac{1}{6}\sum_{j} \max(Q^{k}(i, \text{"Stop"}), Q^{k}(i, \text{"Roll"})) = \frac{1}{6}\sum_{j} \max(q(k), j)$

e. $q(k) > 5$.

3. a. $V^*_{opt}(3,2) = \max\{100 + 0.5 \cdot 0,\ 80 + 0.5 \cdot 0\}$

$= 100$

$V^*_{opt}(2,2) = \max\{-80, -100, 0 + 100 \cdot 0.5, 0 + 80 \cdot 0.5, 0 + 25 \cdot 0.5\} = 50$

$V^*_{opt}(1,3) = \max\{-80, 0 + 25 \cdot 0.5\} = 12.5$

3. b. $Q((3,2), N) = (1-\alpha) Q((3,2), N) + \alpha(R((3,2), N, s') + \gamma \max_{a'} Q(s', a'))$

$= 0.5 \cdot 0 + 0.5(100 + 0.5 \cdot 0) = 50$

$Q((1,2), S) = 0.5 \cdot 0 + 0.5(0 + 0) = 0$

$Q((2,2), E) = 0.5 \cdot 0 + 0.5(0 + 0.5 \cdot 100) = 25$

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3. c. i. $w_i \leftarrow w_i + \alpha[r + \gamma \max_{a'} Q(s', a') - Q(s,a)] f_i(s,a)$

$w_1 = 0 + 0.5[-100 - 0] f_1(s,a)$

$= -50 \cdot 2$

$= -100$

$w_2 = 0 + 0.5[-100 - 0] f_2(s,a)$

$= -50 \cdot 2$

$= -100$

$w_3 = 0 + 0.5[-100 - 0] f_3(s) = -50 \cdot 2 = -100$

ii $\arg\max_a Q((2,2),a) = \max\{Q((2,2),N), Q((2,2),E),$

$Q((2,2),W), Q((2,2),S)\}$

$= \arg\max_a \{(1\cdot2+2\cdot1+1\cdot1), (2+2+3), (2+2+4), (2+2+2)\}$

$= \arg\max_a \{5, 7, 8, 6\}$

= West

4. a. ii) LWSN → ELLT → HAAS → SC → BRNG → PMU

iii)

Unexplored	Frotier	Explored
LWSN	LWSN ,3	LWSN ,3
ELLT	ELLT , 7	ELLT, 7
HAAS	HAAS, 5	
SC	SC , 6	
BRNG		
PMU	PMU, 9	
REC		

LWSN → ELLT → HAAS → SC → PMU.

iv) LWSN → ELLT → HAAS → SC → PMU (same as UCS, except using h)

b. $cost'(LWSN, 4) = 4 + 2 - 3 > 0$

$cost'(LWSN, 3) = 4 + 1 - 3 > 0$

$cost'(LWSN, 2) = 4 + 5 - 3 > 0$

$cost'(ELLT, 2) = 2 + 0 - 2 \geq 0$

$cost'(PMU, n) = 0 + 0 \geq 0$

$cost'(SC, 1) = 1 + 0 - 1 \geq 0$

$cost'(HAAS\ 3) = 3 + 2 - 5 \geq 0$

$cost'(BRNG, 1) = 1 + 1 - 2 \geq 0$

$cost'(REC, 2) = 2 + 0 - 1 > 0$

$h(PMU) = 0$

→ consistent heuristics

→ admissible.