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CECS 451
ASS # 11

1. Find p with a scale of 4 i.e 0.1234

$$\vec{P}(R_t \mid u_{1:t}) = \vec{P}(R_{t-1} \mid u_{1:t-1}) = \langle p, 1-p \rangle$$

$$[p, 1-p] = \alpha \cdot [0.7, 0.3] \cdot \left([0.9, 0.1] \cdot p + [0.2, 0.8] \times (1-p) \right)$$

$$= \alpha \cdot [0.7, 0.3] \cdot ([0.9, 0.1] \cdot p + [0.2 - (0.2) \cdot p, 0.8 - (0.8) \cdot p]$$

$$= \alpha \cdot [0.7, 0.3] \cdot (0.2 + 0.7 \cdot p, 0.8 - 0.7 \cdot p])$$

$$= \alpha \cdot [0.49 \cdot p + .14, 0.24 - 0.21 \cdot p]$$

$$= \frac{1}{0.28 \cdot p + .38} \cdot [0.49 \cdot p + .14, 0.24 - 0.21 \cdot p]$$

$$= p(0.28 \cdot p + 0.38)$$

$$= 0.49 \cdot p + 0.14$$

$$= 0.28 \cdot p^2 + 0.38 \cdot p = 0.49 \cdot p + 0.14$$

$$0.28 \cdot p^2 - 0.11 \cdot p - 0.14 = 0$$

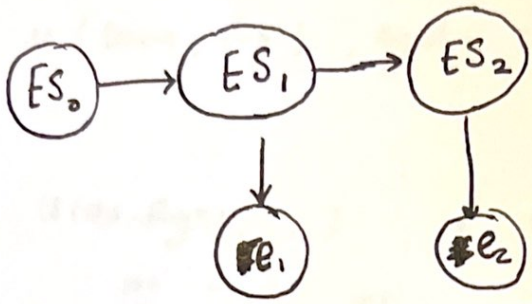
$$\vec{P}(R_t \mid u_{1:t}) = [0.9304, 0.0696]$$

$$P = 0.9304$$

2. (a) ES = Enough Sleep

$P(ES_0) = 0.7$

ES_{t-1}	$P(ES_t \mid ES_{t-1})$
t	0.8
f	0.3



*e = red eyes

ES_t	$P(*e_t \mid ES_t)$
t	0.2
f	0.2

b. $\vec{P}(ES_2 \mid e_{1:2}) = [0.7056, 0.2944]$

$$P(ES_1) = \sum_{es_0} P(ES_1 \mid es_0) \cdot P(es_0)$$

$$= \begin{bmatrix} P(es_1 \mid es_0) \cdot P(es_0) + P(es_1 \mid \neg es_0) \cdot P(\neg es_0) \\ P(\neg es_1 \mid es_0) \cdot P(es_0) + P(\neg es_1 \mid \neg es_0) \cdot P(\neg es_0) \end{bmatrix}$$

$$= \begin{bmatrix} (0.8)(0.7) + (0.3)(0.3) \\ 1 - 0.65 \end{bmatrix}$$

$$= [0.65, 0.35]$$

$P(ES_1 \mid *e_1) = \alpha \cdot P(ES_1, *e_1) = \alpha \cdot P(ES_1) \cdot P(*e_1 \mid ES_1) = \alpha \cdot [0.65, .35) \times [0.2, 0.7)$

$= [0.3467, 0.6533]$

$P(ES_2 \mid e_1) = \sum_{es_1} P(ES_2 \mid es_1) \cdot P(es_1 \mid e_1) = [0.4733, 0.5267]$

$P(ES_2 \mid e_1, \neg e_2) = \alpha \cdot P(ES_2, e_1, \neg e_2) = \alpha \cdot P(ES_2 \mid e_1) \cdot P(\neg e_2 \mid ES_2)$

$= \alpha \cdot [0.4733, 0.5267] \times [0.8, 0.3]$

$= [0.7056, 0.2944]$

3. a. Up, Down

$$u(\text{Up}, \text{Right}, \ldots, \text{Right}) = 50 - \sum_{i=1}^{100} y^i + 10 \cdot y^{101}$$

$$u(\text{Down}, \text{Right}\ldots, \text{Right} = -50 + \sum_{i=1}^{100} y^i - 10 \cdot y^{101}$$

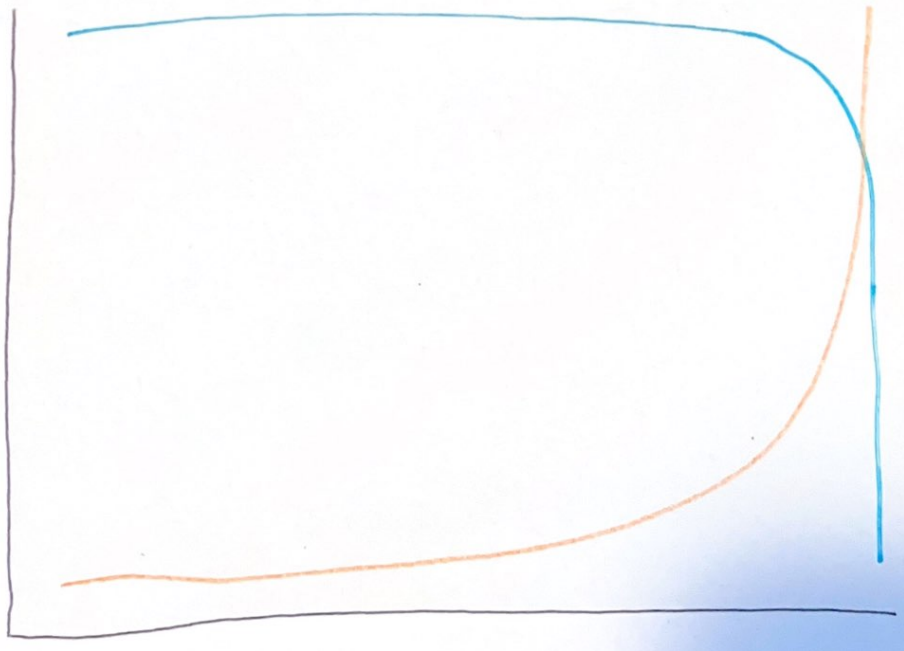
$$u(\text{Up}, \text{Right}, \ldots) = u(\text{Down}, \text{Right}\ldots)$$

$$50 - \sum_{i=1}^{100} y^i + 10 \cdot y^{101} = -50 + \sum_{i=1}^{100} y^i - 10 \cdot y^{101}$$

$$100 = 2 \cdot \sum_{i=1}^{100} y^i - 2 \cdot y^{101}$$

$$y = 0.985$$

(b)



(c) Up because the utility is larger.