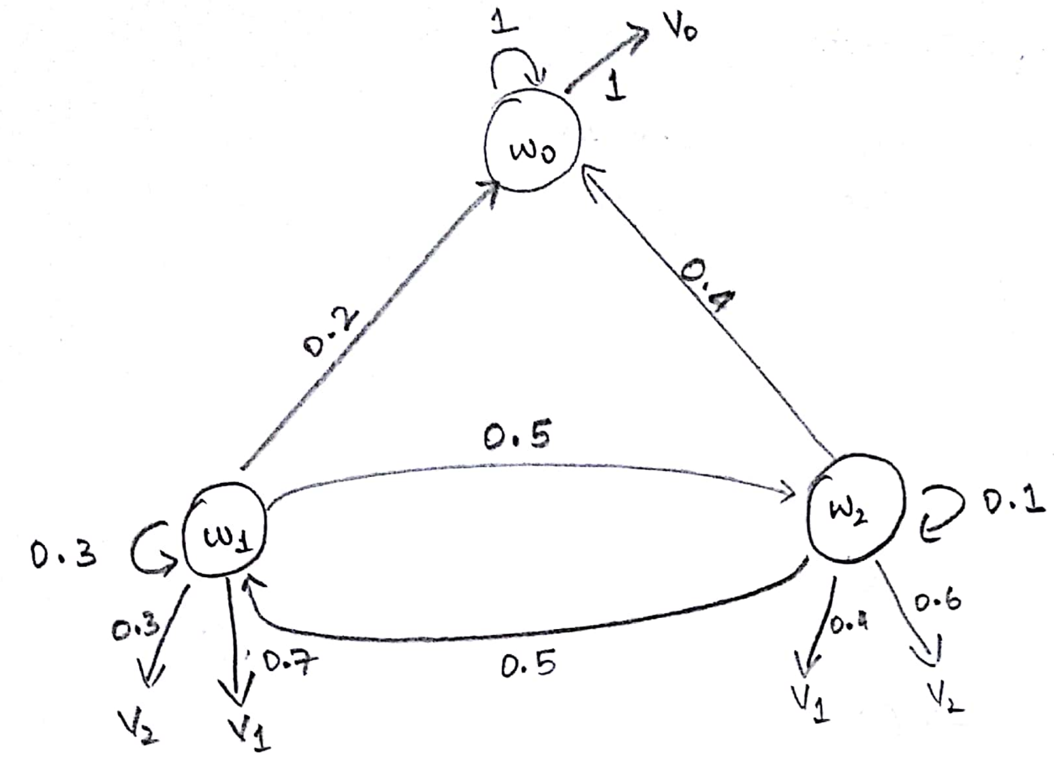
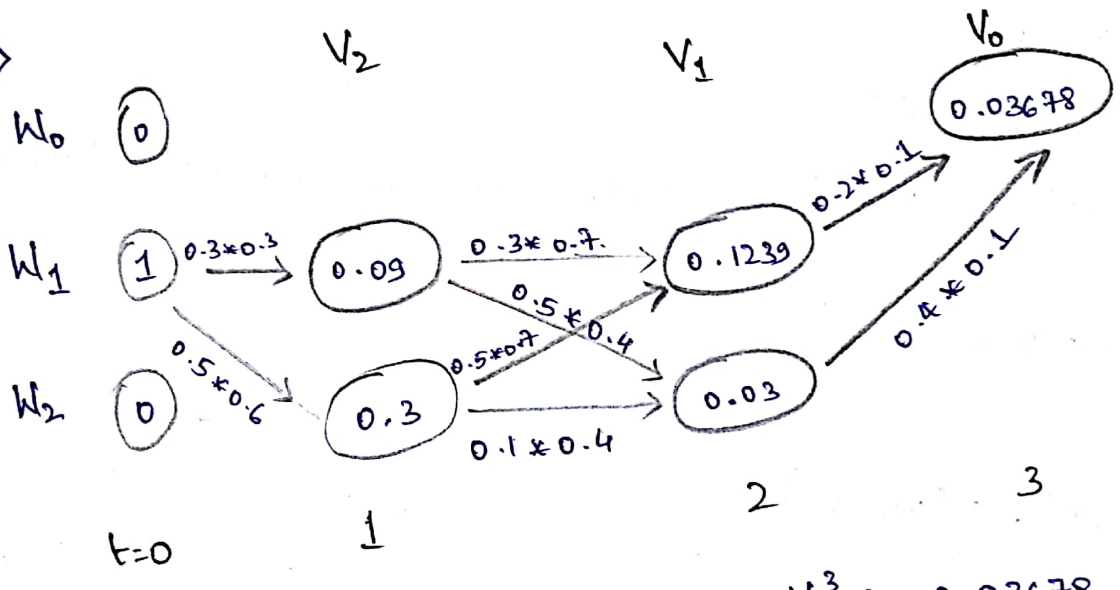
Solution for Question 1 –

a)



b)



The probability of observing the sequence V^3 is $\underline{\underline{0.03678}}$.

c) From the figure above, we can deduce that the most probable sequence of hidden states is $\{w_1, w_2, w_1, w_0\}$.

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Solution for Question 2 -

Filling in the probabilities for the matrix,

	w_1	w_2	w_3	$(w_i, *)$
w_1	0.25	0.0	0.25	0.50
w_2	0.125	0.0	0.0	
w_3	0.0	0.125	0.25	
$(*, w_j)$		0.125		

$$(w_i, *) = \sum_{j=1}^{3} p(w_i, w_j) \rightarrow (1)$$

$$(*, w_j) = \sum_{i=1}^{3} p(w_i, w_j) \rightarrow (2)$$

Eqn (1) makes $p(w_1, w_2) = 0.0$

Eqn (2) makes $p(w_3, w_2) = 0.125$

The sum of all 9 entries should be 1.0, hence the remaining entries become 0.0

Hence, $p(w_1, w_2) = 0.0$

Now,

$$p(w_2|w_3)\, p(w_3, *) = p(w_3, w_2)$$

So, $$p(w_2|w_3) = \frac{p(w_3, w_2)}{p(w_3, *)} = \frac{0.125}{0.375} = \frac{1}{3}$$

→ Solution for Question 3

$V = 10{,}000$

a) MLE of $P(\text{clever} \mid \text{donkey}) = \dfrac{c(\text{donkey}, \text{clever})}{c(\text{donkey})} = \dfrac{5}{10} = \underline{\underline{0.5}}$

b) Laplace estimate of $P(\text{clever} \mid \text{donkey}) = \dfrac{c(\text{donkey}, \text{clever}) + 1}{c(\text{donkey}) + 10{,}000} = \dfrac{6}{10{,}010} = \underline{\underline{5.994 \times 10^{-4}}}$