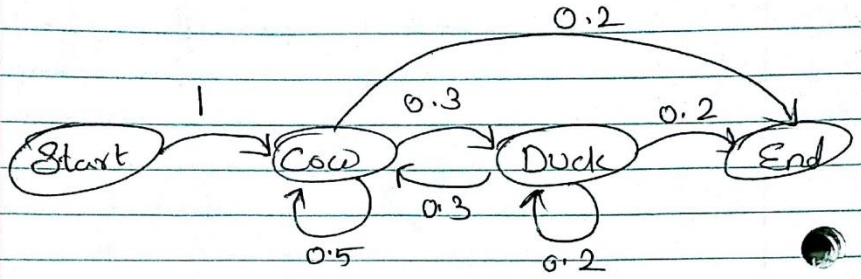
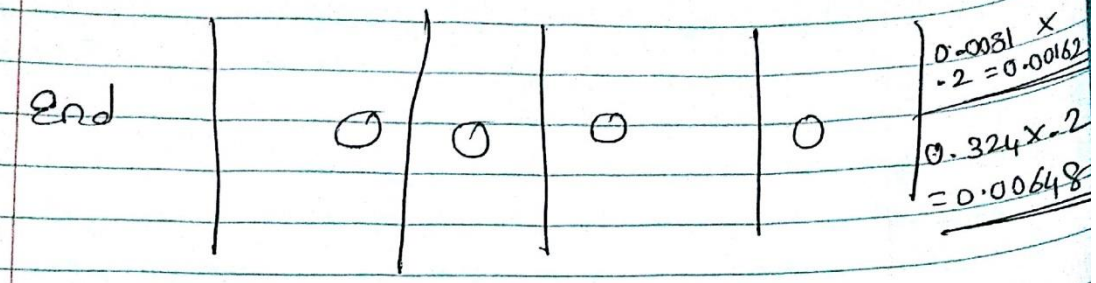
1.

(1) a) $P\left(\frac{moo}{cow}\right) = 0.9$, $P\left(\frac{quack}{duck}\right) = 0.6$.

$P\left(\frac{hello}{cow}\right) = 0.1$, $P\left(\frac{hello}{duck}\right) = 0.4$



S	Start	moo	hello	quack	End
Start	1	0	0	0	0
Cow	0	$1 * 0.9 = 0.9$	$.9 \times .5 \times .1 = 0.045$	0	0
Duck	0	0	$.9 \times .3 \times .4 = 0.108$	$0.045 \times .3 \times .6 = 0.0081$ $0.108 \times .5 \times .6 = 0.324$	0



∴ The transition

Start → Coco → duck → duck → End
is more likely with probability
0.00648

(b) yes.

Start → coco → coco → duck → End

probability = 0.00162.

Total probability = 0.00648
+ 0.00162

= 0.00810

2. a.

Sentence: He is sleeping on the bed.
Annotate He == <constit cat="PRP">
Annotate is == <constit cat="VBZ">
Annotate sleeping == <constit cat="VBG">
Annotate on == <constit cat="IN">
Annotate the == <constit cat="DT">
Annotate bed == <constit cat="NN">
Annotate . == <constit cat=".">

b.

Sentence: I will sleep and wake up early.
Annotate I == <constit cat="PRP">
Annotate will == <constit cat="MD">
Annotate sleep == <constit cat="VB">
Annotate and == <constit cat="CC">
Annotate wake == <constit cat="NN">
Annotate up == <constit cat="IN">
Annotate early == <constit cat="JJ">
Annotate . == <constit cat=".">

In this sentence, wake is tagged as NN. It should be VBP (verb present tense)

STATE VBP = 14955
EMIT WAKE = 2

So, Emission probability of WAKE as VBP = 2/14955 = 0.0001337

STATE NN = 159394
EMIT WAKE = 55

So, Emission probability of WAKE as NN = 55/159395 = 0.000345

Now, looking at the sequence, wake comes after “and” (which is a CC)

STATE CC 28585

ARC TO VBP 344
ARC TO NN 3399

Transition probability of VBP = 0.0120
Transition probability of NN = 3399/28585 = 0.1189

So, the probability of wake being NN and VBP are
P(VBP) = 0.0001337 * 0.0120 = 0.0000016
P(NN) = 0.000345 * 0.1189 = 0.000051

So, the probability of wake being NN is more than the probability of it being NN. Hence, it was tagged as NN and not VBP.