Name:_____

Question 1: Write out the joint probability for the following sentence using the chain rule:

p(There, is, only, one, person, who, is, not, ordinary)

Answer:

p(There, is, only, one, person, who, is, not, ordinary)
=*p(There)p(is|There)p(only|There,is)p(one|There,is,only)p(person|There,is,only,one)p(who|There,is,only,one,person)p(is|There,is,only,one,person,who)p(not|There,is,only,one,person,who,is)p(ordinary|There,is,only,one,person,who,is,not)*

Write out the probability above using the second-order Markov assumption.

Answer:

p(There, is, only, one, person, who, is, not, ordinary)
=*p(There)p(is|There)p(only|There,is)p(one|is,only)p(person|only,one)p(who|one,person)p(is|person,who)p(not|who,is)p(ordinary|is,not)*

Question 2: Consider the following training corpus **T** of sentences:

- *START Karlsson is round STOP*
- *START He lives on the roof STOP*
- *START He is happy STOP*
- *START On the roof STOP*
- *START Karlsson lives happily STOP*

(b) Compute the following maximum likelihood parameters:

p(Karlsson|START)=count(START,Karlsson)/count(START)=2/5

p(Karlsson|lives,happily)=count(lives,happily,Karlsson)/count(lives,happily)=0/1

p(STOP|happy)=count(happy,STOP)/count(happy)=1/1

(c) Compute the probability of the following sentences under the trigram model trained on **T**:

START Karlsson is happy STOP

Answer:

p(START,Karlsson,is,happy,STOP)
=p(Karlsson|START)p(is|START,Karlsson)p(happy|Karlsson,is)p(STOP|is,happy)
=count(START,Karlsson)/count(START)*count(START,Karlsson,is)/count(START,Karlsson)*
count(Karlsson,is,happy)/count(Karlsson,is)*count(is,happy,STOP)/count(is,happy)
=2/5*1/2*0/1*1/1=0

START Karlsson lives on the roof STOP
Answer:
p(START,Karlsson,lives,on,the,roof,STOP)
=p(Karlsson|START)p(lives|START,Karlsson)p(on|Karlsson,lives)p(the|lives,on)p(roof|on,the)p(
STOP|the,roof)
=count(START,Karlsson)/count(START)*count(START,Karlsson,lives)/count(START,Karlsson
)*count(Karlsson,lives,on)/count(Karlsson,lives)*count(lives,on,the)/count(lives,on)*count(on,th
e,roof)/count(on,the)*count(the,roof,STOP)/count(the,roof)
=2/5*1/2*0/1*1/1*2/2*2/2=0