COMP 476 Assignment 3 Theory Questions

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**Question #1**

The first thing we do is actually set up our data in hierarchical fashion. This is shown below.

Training Data:

L R R R L R R L L R L R L R L R R L R R L R L R R L L R R L R R

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1-Gram | | | | 2-Gram | | | | 3-Gram | | | |
| Obs. | ..R | ..L | Samp. | Obs. | ..R | ..L | Samp. | Obs. | ..R | ..L | Samp. |
| - | 19/32 | 13/32 | 32 | L | 11/13 | 2/13 | 13 | LL | 2/2 | 0/2 | 2 |
|  | | | | R | 8/18 | 10/18 | 18 | LR | 7/11 | 4/11 | 11 |
|  | | | | RL | 8/10 | 2/10 | 10 |
| RR | 1/7 | 6/7 | 7 |

1. Input string is RRR, so the best we can do is look at the last two R’s and use our 3-Gram. So given the fact that we have just seen 2 R’s the predicted next action for the 3-Gram would be L since the probability of this is 6/7. Since we have 7 observations of this, and this exceeds our threshold of 5, we don’t have to go lower in the hierarchy and so we predict that the next action will be L.
2. Since we need at least 15 samples for prediction, we cannot use the 3-Gram predictor since we only have 7 samples. So looking at the 2-Gram with the last action as R, we predict that the next action will be L since this has a probability of 10/18 which is greater than R’s probability (8/18) and this 2-Gram has 18 samples which meets our 15 sample requirement for prediction.
3. Here, since we need 30 samples for prediction, we have to go all the way down to the 1-Gram to predict since this one has 32 samples to predict with. Here we are simply looking at the total probability of R and L based on no previous knowledge. Since R has the greater probability of occurring overall, we predict the next action to be R in this case.