ADVANCED METHODS IN NLP
EXERCISE #3 SOLUTION

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Question 2

(b) The accuracy in most frequent model on dev set is **92.31%**

Question 3

(b) We tune the λ_i parameters using a grid search. Our optimal parameters are: We arrive at the following results:

λ_1	λ_2	λ_3	Accuracy
0	0	1	0.923
0	0.1	0.9	0.936
0	0.2	0.8	0.941
0	0.3	0.7	0.944
0	0.4	0.6	0.946
0	0.5	0.5	0.947
0	0.6	0.4	0.949
0	0.7	0.3	0.950
0	0.8	0.2	0.951
0	0.9	0.1	0.951
0	1	0	0.615
0.1	0	0.9	0.938
0.1	0.1	0.8	0.942
0.1	0.2	0.7	0.945
0.1	0.3	0.6	0.947
0.1	0.4	0.5	0.949
0.1	0.5	0.4	0.950
0.1	0.6	0.3	0.951
0.1	0.7	0.2	0.952
0.1	0.8	0.1	0.952
0.1	0.9	0	0.615
0.2	0	0.8	0.943
0.2	0.1	0.7	0.946
0.2	0.2	0.6	0.949
0.2	0.3	0.5	0.950
0.2	0.4	0.4	0.951
0.2	0.5	0.3	0.952
0.2	0.6	0.2	0.953
0.2	0.7	0.1	0.953
0.2	0.8	0	0.615
0.3	0	0.7	0.947
0.3	0.1	0.6	0.949
0.3	0.2	0.5	0.950

0.3	0.3	0.4	0.952
0.3	0.4	0.3	0.953
0.3	0.5	0.2	0.954
0.3	0.6	0.1	0.954
0.3	0.7	0	0.788
0.4	0	0.6	0.949
0.4	0.1	0.5	0.951
0.4	0.2	0.4	0.953
0.4	0.3	0.3	0.954
0.4	0.4	0.2	0.954
0.4	0.5	0.1	0.955
0.4	0.6	0	0.788
0.5	0	0.5	0.951
0.5	0.1	0.4	0.952
0.5	0.2	0.3	0.954
0.5	0.3	0.2	0.954
0.5	0.4	0.1	0.955
0.5	0.5	0	0.615
0.6	0	0.4	0.952
0.6	0.1	0.3	0.954
0.6	0.2	0.2	0.954
0.6	0.3	0.1	0.955
0.6	0.4	0	0.788
0.7	0	0.3	0.954
0.7	0.1	0.2	0.954
0.7	0.2	0.1	0.955
0.7	0.3	0	0.789
0.8	0	0.2	0.954
0.8	0.1	0.1	0.955
0.8	0.2	0	0.789
0.9	**0**	**0.1**	**0.955**
0.9	0.1	0	0.789
1	0	0	0.615

(c) Viterbi accuracy is: **95.55%.** with: $\lambda_1 = 0.9\lambda_2 = 0, \lambda_3 = 0.1$

Question 4

(d) The accuracy on development set is: Greedy: **95.46%** Viterbi: **96.03%**

(e) A few examples of sentences which Viterbi errs on:
"... members of the House Ways and Means Committee introduced..."

In here Viterbi predicted **Ways** and **Means** to be **NNPS** which stands for proper noun, plural. The actual tag is **NNP** which is proper noun, singular. This kind of mistake seems legitimate because the words end with an "s" which normally indicates a plural form. In here the words are used as names of events and thus are labeled as singular.

"PainWebber also was able to gear up quickly thanks to..."
In here Viterbi predicted **gear** to be **NN** which is non, singular or mass. The actual tag is **VB** which is verb, base form. This mistake makes sense because the phrase has a verb which is "was", and an algorithm could fairly expect the "to" proposition word to be such that reflects the next word ("gear") to be the subject of the verb.