METL – TP2

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Exercise 1 – 10 points

das

e	$t(e\|f)$
the	0.7
that	0.15
which	0.075
who	0.05
this	0.025

Haus

e	$t(e\|f)$
house	0.8
building	0.16
home	0.02
household	0.015
shell	0.005

ist

e	$t(e\|f)$
is	0.8
's	0.16
exists	0.02
has	0.015
are	0.005

klein

e	$t(e\|f)$
small	0.4
little	0.4
short	0.1
minor	0.06
petty	0.04

Given the translation tables above, compute explicitly the translation probability for each of the following translations of the German sentence *das Haus ist klein* (assume the most likely alignment under IBM Model 1):

1. *the house is small*
2. *the house is little*
3. *small house the is*
4. *the*

Answer the following questions:

a. Is the IBM Model 1 by itself a good model for finding the best translation?

b. Explain how the noisy-channel model compensates for some of the problems of IBM Model 1 as a translation model.

1 Exercise 2 – 10 points

Consider the following toy example of the alignment problem. Assume we have two pairs of English-French translations:

(1) (*blue house*, *maison bleue*)

(2) (*the house*, *la maison*)

Compute the first step of the Expectation-Maximization algorithm on these data to estimate translation probabilities for IBM model 1 (for simplicity, do not consider alignments to the empty word NULL). More precisely, start by assigning uniform values to translation parameters $t(f|e)$. Then calculate the probabilities of all possible alignments $p(a|e, f)$ for these sentences (E-step) and the updated translation probabilities (M-step). Provide the details of your calculations, including the formula.