For office use only	Team Control Number	For office use only
T1 _____	77238	F1 _____
T2 _____		F2 _____
T3 _____	Problem Chosen	F3 _____
T4 _____	B	F4 _____

2018

MCM/ICM

Summary Sheet

Summary

Thousands of languages are spoken around on the Earth, and over 40% of people take one of the top ten most spoken language as their mother tongue. Meanwhile, more and more people are learning a second language to meet the rapid development of economy and globalization.

Aimed to predict the distribution of widespread language speakers over the next 50 years, we build a Language Development Model, and apply it to countries with a population over 10 million to describe the possibility of the new generation in a certain country studying a certain second language. We employ the Analytical Hierarchy Process (AHP) to determine the specific parameters, and carry out stochastic simulation on Python to produce the results, which shows that mild change takes place on the list of popular languages – only two of the top-10 languages are replaced, while the total number of speakers of several languages gains an impressive increase.

Based on the language distribution model we obtain, we develop a Location Determination Model. The dual-solution model further provide a recommendation for a large multinational service company to select the location of their new international office. One of the solution is oriented by language structure, and the other by geographic condition. Taking language distribution as well as economic development of different countries into account, the model suggests that new offices should be located in Nigeria, India, Germany, Italy, Brazil, Australia for short-term interest, and Nigeria, Russia, Germany, Poland, Brazil, Australia for long-term development.

The sensitivity analysis shows the strong robustness of our model. Variation of key parameters causes moderate changes to the computing result. When we test the sensitivity, we indirectly validate our model's conformance with reality that the direction of fluctuation of the result matches situations in real world. Meanwhile, we further discuss the impact of reducing the number of new office, and provide practicable advice on location determination of new offices.

Key Words: Language Development Model, AHP, Fuzzy Clustering, P-Center Model