Optimal Stopping Problem in Love

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Introduction

Plato once asked Socrates What is Love?. ”Go to that wheat field and bring me the largest ear of wheat, you can only bring one back, and remember, no turning back”, said Socrates. Plato left, but came back empty-handed, and Socrates asked why. Plato said that he saw a big ear of wheat at the beginning but believed that he could find bigger ones later, and ended up coming back empty-handed. ”This is Love.”, said Socrates. Today, thanks to odds algorithm, we know that the optimal strategy of finding the ”largest ear of wheat” is to reject the first 100/e percent of all the candidates, and pick the next one that is ”larger” than all the other previous candidates. The aim of this paper is to demonstrate this result using Monte-Carlo Simulation and extends the result to a ”multidimensional” setting. This paper is structured as the following: Section 1 explains the setup and assumptions of the Dating Problem. Section 2 presents the results and theoretical findings. Section 3 discuss the implication, limitation and future work that can build upon this paper.

1 Setup

Although there can be many variations, the basic assumptions and setup of a love problem can be stated as follows:

A person has one and only one partner/marriage position to be filled.

Throughout the person's lifetime, he or she will encounter n potential candidates for marriage.

These candidates, if all appeared at the same time, can be ranked from most preferred to least preferred.

The person meet the candidates in a random sequential manner, each time meeting/dating at most 1 candidate.

Immediately after meeting the candidate, the person has to decide either to marry the candidate or forget the candidate forever, and this decision is irrevocable.

The objective of the optimal strategy is to maximize the probability of selecting the best candidate for marriage.

2 Results

2.1 First Is Not Always Best

Lemma 1: *If the pool of candidate is large enough, the probability of the first candidate being the best converges to 0.*

Proof: Candidates appear as a random sequence.

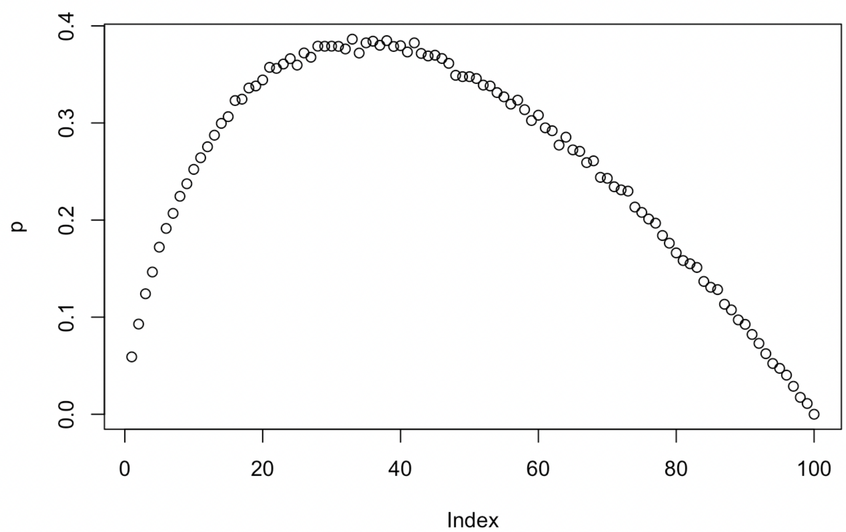
Lemma 2: *Marrying the first candidate is optimal only when the total number of candidates is less than 5.*

Proof:
Simulation result show that at n=5, the optimal strategy is to reject the first 2, and marry the next candidate who is better than both candidate 1 and candidate 2.

Theorem 1: *Using the first candidate as measure and marrying the next candidate who is better than the first is a suboptimal strategy.*

Proof:
Simulation result show that the probability of the next candidate better than the first being the best candidate is 0.057, which is a very high probability.

2.2 37 Percent - The Magic Number



The main result of this paper is the graph above. The horizontal axis shows the candidate threshold, the number of candidates that must be rejected before beginning to start to select for marriage candidate. The y axis show the probability that the next candidate better than all the previously rejected candidates is the best among all possible candidates. As our result show, If a person is destined to meet 100 candidates in his lifetime, then the optimal strategy is to reject the first 37 candidates that a person meet, and marry the next candidate that is better than all the previous 37 candidates.

2.3 The Multivariate Case

In this section we consider a case when the preference of the person to a candidate is determined by 4 variables: Height, Weight, Intellectual Quality, and Emotional Quality. In or example, the person weighs the 4 variables equally, and the person's scoring system for the candidates is as follows:

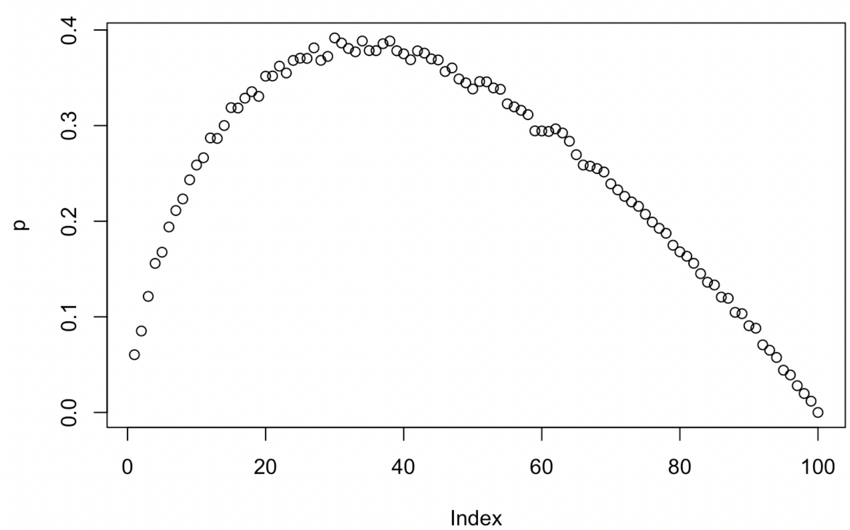
Score for height: 100 goes to the candidate who is 15cm shorter than you, for every 1 cm deviation, the score drops by 5.

Score for weight: 100 goes to the candidate whose weight is 60 kg for every 1 kg deviation, score drops by 2.

Score for IQ: Percentile of IQ

Score for EQ: Percentile of EQ

Score for candidate is the mean of the 4 scores above.



As the simulation result show, for the multi-variable preference case, the optimal strategy remains to be to reject the first 37 candidates that a person meet, and marry the next candidate that is better than all the previous 37 candidates.

3 Discussion and Future Research

The results of this paper are limited in many aspects, with the most obvious limitation being assuming that a person's preference for marriage partner remains deterministic and unchanging throughout the person's lifetime. Despite being imperfect, this paper has some meaningful implication. Suppose we assume an average male starts having the intention to "date" at the age of 13, and the frequency and distribution of meeting potential candidates are constant until he reaches the age 60, then the optimal age to commit to marriage is around 30 years old. Similarily, for women, the optimal age to commit to marriage would be around 25 years old. This result may provide another perspective to Jane Austen's fear, "I'm 27 ... I am a burden to my parents, and I am frightened." An immediate extension to this paper would be an optimization for the search process of candidates. For example, could dating ex's close friends be a more efficient or less volatile strategy? Should We Date Our Ex's Close Friends seems to be a promising title for an Ig Nobel Prize winning research.