Prediction of Single Stage Limit Language and Adult Language via Yusof-Goode Approach

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Abstract. Yusof-Goode (Y-G) rule, a new symbolization of representing rule in splicing system under framework of formal language theory to model the recombinant behaviors of DNA molecules, was introduced by Yusof in 2012. A language that contains the strings resulting from a splicing system is called splicing language. Limit language is a subset of splicing language where it is restricted to the molecules that will be present in the system after the reaction has run to completion. Adult language is a subset of limit language where it does not participate in further splicing. In this paper, the new concept of single stage splicing languages is introduced and some theorems have been formulated to stipulate the final state product of single stage limit languages of Yusof-Goode splicing system based on the characteristic of one initial string andone rule.

Keywords: Yusof-Goode Splicing System; Splicing Languages; Single Stage Limit Language; Adult Language.
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INTRODUCTION

Splicing system was initially introduced by Head [1] as a formal characterization of the generative capacity of specified enzymatic activities acting on initial deoxyribonucleic acid (DNA) molecules via Framework of Formal Language theory. The DNA molecules have four different bases which consist of adenine (A), guanine (G), thymine (T) and cytosine (C), where A'shydrogen bonds to T's, G'shydrogen bonds to C's, C'shydrogen bonds to G'sand T'shydrogen bonds to A's based on Watson-Crick complementary [2].DNA molecules can be cut by some restriction enzymes at recognition sites, producing molecules with sticky or blunt ends [2]. Only sticky ends will be considered in this paper since any blunt ended DNA can be ligated to any other blunt ended DNA disregard to the sequence of the two molecules, thus producing infinite splicing languages. In fact, sticky ends which facilitate the joining of DNA segments with matching protrusions can be ligated much more readily than blunt ended fragments, presumably because hybridization between the single stranded regions holds the fragments together in the proper position for ligation [3]. In 2012[4], non semi-simple splicing system restricted to two restriction enzymes were introduced by Yusof. Based on [7], a new notation of writing rules in splicing system called Yusof-Goode (Y-G) notation which is associated with Y-G splicing system was introduced. This new splicing system was based on the characteristics of the restriction enzyme itself, with some modifications from Head's and Goode-Pixton's splicing systems. Laboratory experiment has shown the non-uniqueness of limit languages by using minimal restriction enzymes and initial strings of double strand DNA [4, 6]. Y-G splicing system plays a pivotal role in attempts to recombine sets of double stranded DNA molecules when acted on by restriction enzymes and a ligase, which is currently estimated to cost around $300 per restriction endonuclease if to conduct laboratory experiments. Hence, this study will focus on the prediction of single stage limit language restricted to one rules based on different characteristic of initial strings and restriction enzymes. The definition of single stage limit language, several examples and theorems to show the existence of limit language and adult language are illustrated in this paper. In biological perspective, the molecules that will be presented in the system after the reaction has run to completion are predicted in order to optimize time and money.

PRELIMINARIES

In this section, some fundamental definitions used in this paper are listed. The definitions of Y-G splicing system and splicing language are stated below:

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