An Analysis of Four Variants of Splicing System

Yuhani Yusof[a], Nor Haniza Sarmin[b], Fong Wan Heng[c], T. Elizabeth Goode[d] and Muhammad Azrin Ahmad[b]

[a]*Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, 26300 Gambang, Pahang DM, Malaysia*
[b]*Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM JB, Johor DT, Malaysia*
[c]*Ibnu Sina Institute for Fundamental Science Studies, Universiti Teknologi Malaysia, 81310 UTM JB, Johor DT, Malaysia*
[d]*Department of Mathematics, Towson University, 7800 York Road, MD, USA*

Abstract. The theoretical development of splicing system has led to the formulation of new extension of splicing system, namely Yusof-Goode (Y-G) splicing system. This Y-G splicing system, which is associated with Y-G splicing rule, is introduced to show the transparent biological process of DNA splicing. In this paper, a theoretical analysis has been carried out to investigate the similarities and differences between Y-G splicing system with the existing splicing systems namely, Head, Paun and Pixton splicing system in biological point of view.

Keywords: Yusof-Goode splicing system, DNA splicing system
PACS: 87.14.gk, 87.14.ej

INTRODUCTION

The study of recombinant behavior of deoxyribonucleic acid or DNA has been extensively explored. Head's model pioneered the research followed by Paun's and Pixton's model. In this paper, those three models are reviewed. In addition, a new model, namely Y-G splicing system that associates with Y-G notation of rule is presented. Besides, the relations of different notations used for these four splicing models are also discussed.

Preliminaries

In this section, some basic definitions related to formal language theory are given. Hence, three related definitions are presented. It is started with prefix and suffix of a string.

Definition 1: Prefix and Suffix of a String
Any string of consecutive symbols in some word w is said to be a substring of w. If $w = vu$ then the substrings v and u are said to be a prefix and a suffix of w, respectively.
For example, if $w = abbab$, then $\{\lambda, a, ab, abb, abba, abbab\}$ is the set of all prefixes of w, while bab, ab, b are some of its suffixes.□ [1]

In the following definitions, another two basic concepts are presented namely symmetric and reflexive.

Definition 2[2]: Symmetric
A set of rules R is symmetric if, for each rule $(u,v';u',v)$ in R, $(u',v;u,v')$ is in R.□

Definition 3[2]: Reflexive
A set of rules R is reflexive if, for each rule (u,v',u',v) in R, the rules (u,v',u,v') and (u',v,u',v) are also in R.□

It is obvious to present the meaning of the transitivity of the rule R based on the above two stated definitions. A rule set R is transitive if, for each rule $(u,v;u',v')$ and $(u',v';u'',v'')$ in R, then $(u,v;u'',v'')$ is also in R.

In the next section, three existed splicing systems are reviewed.

Proceedings of the 20th National Symposium on Mathematical Sciences
AIP Conf. Proc. 1522, 888-895 (2013); doi: 10.1063/1.4801223