



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS

Name of the Student : Mrityunjay Singh  
Roll Number : 10610108  
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Name of Thesis Supervisor(s) : Dr. Benny George Kenkireth  
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**SHORT ABSTRACT**

In this thesis, we look at various notions of patterns and pattern avoidance in words. The three themes we have looked at are pattern avoidance on two dimensional words, pattern based word representability of graph and quasiperiodicity patterns and their allied properties in Tribonacci words. A mapping  $f$  from  $Z$  times  $Z$  to  $\Sigma$  is called a two dimensional word. For each discrete line of a two dimensional word, we can get a one dimensional word by concatenating letters present at the lattice points of the line. If each of these one dimensional words are square free then we say that two dimensional word is square free. We prove that there are no two dimensional square free words on 8 letters. For a given word  $w$ ,  $G_w$  stands for alternating letter graph corresponding to  $w$ . Formally,  $G_w = (V_w, E_w)$  where  $V_w$  is the set of letters in  $w$  and  $(a,b) \in E_w$  if the letters  $a$  and  $b$  are alternating in  $w$ . We say that a word  $w$  represents a graph  $G$  if  $G_w = G$ . We give a linear time algorithm to check if a two uniform word  $w$  represents  $G$ . We study the problem of counting the number of two uniform representants of the cycle graph and show that the number of two uniform representants of the cycle graph on  $n$  vertices is  $4n$ . We looked at the notion of uniform permutation representability of graphs and found graphs which are  $(k,p)$ -representable for some particular  $k$  and  $p$ . A word is quasiperiodic if a finite length factor covers each of its indices. The Tribonacci words are a family of words generated using the Tribonacci-Rauzy morphisms. We find various parameters related to the quasiperiodicity of the Tribonacci words.