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## SOME CHARACTERIZATIONS OF COXETER GROUPS

by Vinay V. DEODHAR <sup>1)</sup>

ABSTRACT: The aim of this note is to compile together various characterizations of Coxeter groups. Some of these are well-known, some are not-so-well-known and some are entirely new. The motivation behind the new ones is explained in the introduction.

### § 1. INTRODUCTION

Coxeter groups originally arose as group of symmetries of various geometrical objects. These became the center of activity in Lie Theory because of fundamental work of E. Cartan, H. Weyl and others regarding the structure of semi-simple Lie algebras. A little later on, Coxeter gave a complete classification of finite groups generated by reflections which included the Weyl groups, the dihedral groups and two sporadic groups ( $H_3$  and  $H_4$ ). In doing so, he gave a presentation of these groups which then led to other families of groups which have similar presentations. These include the affine Weyl groups and this is motivation enough to develop the theory of general Coxeter groups. Such a study was initiated around late 60's and an important characterization in terms of the so-called exchange condition was given (cf. [B], [S]). In recent years, this theory has been further developed and a lot of important work has been done. A major part of this work is in connection with the Bruhat ordering and its role in various different contexts in Lie theory ([K-L]). Another object under investigation is the so-called root-system of a general Coxeter group. It is seen that a number of properties of Coxeter groups can be derived using these root-systems ([D]). In an attempt to understand the role of the above two concepts in this theory, the author found out that these two

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