



T. TSUZUKU

Dedication

Professor Tosiro TSUZUKU was born on October 10, 1929 in Miyanokoshi, Nagano prefecture, a small village in a mountaineous area in Central Japan, and he grew up there. He studied mathematics in Nagoya University under the influence of Professors T. Nakayama and G. Azumaya. After graduating, he was appointed Assistant of the Department of Mathematics of Nagoya University in April 1956, where he was received the degree of Doctor of Science in November 1961. He was promoted to Lecturer in December 1961, and to Professor in December 1966 in the same university. In April 1968, he was appointed Professor in the Department of Mathematics of Hokkaido University, and he has stayed in this position since then. He spent two years from 1964 to 1966 in studying finite group theory in University of Illinois at the invitation of Professor M. Suzuki, and in 1972 he stayed in München for a half year as a visiting Professor of Universität München at the invitation of Professor F. Kasch.

The main area of his research has been in finite group theory and finite geometry except for some joint works with Professor Nakayama in the early years. He wrote some important papers on multiply transitive groups and finite geometry. Particularly, his study on projective geometry is essential for Tits theory of spherical building of type A_n .

As a teacher of mathematics, he had many graduate students, who are now working as active mathematicians. Moreover, he wrote two text books. One is on group theory for beginners, and the other is on finite groups and finite geometry. This second book was translated into English and published by Cambridge University Press in 1982.

Tsuzuku is also known as an organizer of a lot of conferences, particularly the annual meetings of finite group theory and the conferences on algebra in Japan. Furthermore, he organized the international Sapporo conference on finite group theory held in Hokkaido University in 1974.

We sincerely hope Professor Tsuzuku will continue to inspire us in research and teaching.

Tomoyuki Yoshida

Mathematical Works of T. Tsuzuku

Papers

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- [2] On a conjecture of Kaplansky on quadratic forms, J. Math. Soc. Japan 6 (1954), 325-331.
- [3] On projective modules (in Japanese), Proc. Sūgaku Sinkōkai 5 (1958).
- [4] (with T. Nakayama) A remark on Frobenius extensions and endomorphism rings, Nagoya Math. J. 15 (1959), 9-16.
- [5] (with T. Nakayama) On Frobenius extensions I, Nagoya Math. J. 17 (1960), 89-110.
- [6] (with T. Nakayama) On Frobenius extensions II, Nagoya Math. J. 19 (1961), 127-148.
- [7] On multiple transitivity of permutation groups, Nagoya Math. J. 18 (1961), 93-109.
- [8] (with T. Nakayama) Correction to our paper "On Frobenius extensions II", Nagoya Math. J. 20 (1962), 205.
- [9] A remark on decompositions of the permutation representation of a permutation group, Nagoya Math. J. 22 (1963), 79-82.
- [10] On permutation representations of finite simple groups (in Japanese), Proc. Symposium on Algebra 4 (1963).
- [11] A characterization of finite projective linear groups, Proc. Japan Acad. 40 (1964), 155-156.
- [12] On Frobenius extensions (in Japanese), Proc. Symposium on Algebra 6 (1964).
- [13] On primitive extensions of rank 3 of symmetric groups, Nagoya Math. J. 27 (1966), 171-177.
- [14] On $LF_4(p)$ (in Japanese), Proc. Sūgaku Sinkōkai 10 (1968).
- [15] On doubly transitive permutation groups of degree $1+p+p^2$ where p is a prime number, J. Algebra 8 (1968), 143-147.
- [16] Transitive extensions of certain permutation groups of rank 3, Nagoya Math. J. 31 (1968), 31-36.
- [17] On permutation groups of degree $1+q+\dots+q^n$ (in Japanese), Proc. Sūgaku Sinkōkai 13 (1971).
- [18] On $LF_3(3)$, J. Fac. Sci. Hokkaido Univ. Ser. I 22 (1972), 104-107.
- [19] On a characterization of $PSL_4(p)$, J. Math. Kyoto Univ. 13 (1973), 49-52.
- [20] On a problem of D. G. Higman, Hokkaido Math. J. 4 (1975), 300-302.

Books

- [21] Finite groups and finite geometries (in Japanese), Iwanami Shoten, Tokyo, 1976.
- [22] Introduction to group theory (in Japanese), Saiensusha, Tokyo, 1977.
- [23] Finite groups and finite geometries, Cambridge University Press, Cambridge-New York, 1982.

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Abstract: In this note various old and new combinatorial facts related to the so called *cyclotomic identity* are presented and discussed.

Introduction

Around 1800 C. F. Gauss considered the problem to compute the number $M(q, n)$ of irreducible polynomials of degree n over the finite field F_q with q elements and solved it in the following way (cf. [G]): Combining the two facts that there are precisely q^n polynomials of degree n with leading coefficient 1 and that every such polynomial decomposes uniquely into a product of irreducibles he derived the so called *cyclotomic identity*

$$\frac{1}{1-qt} = \prod_{n \geq 1} \left(\frac{1}{1-t^n} \right)^{M(q, n)} \tag{1}$$

which in turn allowed him to determine the numbers $M(q, n)$ by considering its logarithmic derivative. Thereby he obtained (in modern notation and with μ denoting the Moebius function)

$$n \cdot M(q, n) = \sum_{d|n} \mu(d) q^{n/d}$$

In 1872 M. C. Moreau discussed in [M] necklaces with n beads which are coloured with q colours and obtained for the number $M'(q, n)$ of *primitive* or *aperiodic* necklaces the same formula:

$$n \cdot M'(q, n) = \sum_{d|n} \mu(d) q^{n/d}$$

In a paper of E. Witt from 1937 (cf. [W1]) the same number occurs as the dimension of the submodule of homogeneous elements of degree n in the free Lie algebra with q generators. Witt wondered why his number coincides with the number of irreducible polynomials, determined by Gauss.

Today, there are well understood explanations for these coincidences. Consider for a (finite) set A the set $P(A)$ of periodic functions on the integers Z with values in the set A together with the *shift map*