and there is a cyclic part of length 7:

13139, 6725, 4338, 4514, 1138, 4179, 9219.

Therefore *there are six different cyclic parts for* $k = 4$.

We are now calculating the cyclic parts for $k = 5$ by an automatic computer FACOM as well as IBM 602 A.

References

[1] K. Iséki, *A problem of number theory*, Proceedings of Japan Academy 36 (1960), 578-583.

[2] K. Iséki, *Necessary results for computation of cyclic parts in Steinhaus problem*, Proceedings of Japan Academy 36 (1960), 650-651.

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Computation of cyclic parts of Steinhaus problem for power 5 *

by

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This paper is concerned with an arithmetic problem. As the problem was appeared in H. Steinhaus, *Sto zadań* (100 problems), we call it Steinhaus problem. (For the related terminologies, see [1], [2]). Some of the present writers found all cyclic parts of Steinhaus problem for powers 3 and 4. (For power 4, see [1]). In this paper, we shall decide all cyclic parts for power 5.

For the purpose, we calculated the cyclic parts of natural numbers less than 3×10^5, as stated in [2]. For the numerical calculation, we used two different types of the automatic computers: Fuji Automatic Computer (FACOM) 128 B and IBM punched cards system 602 A. The calculation from 2 to 10^5 and from 2×10^5 to 3×10^5 was automatically done by FACOM 128 B, the other by IBM 602. We found the following cyclic parts:

length 1:						
	1					(1)
	54748					(247)
	93084					(3489)
	92727					(22779)
	194979					(147999)
length 2:						
	145	4150				(145)
	76438	58618				(199)
	157596	89883				(38889)
length 4:						
	50062	10933	59536	73318		(4)
length 6:						
	44155	8299	150898	127711	33649	
	68335					(16)
length 10:						
	83633	41273	18107	49577	96812	
	99626	133682	41063	9044	61097	(5)
	92873	108899	183635	44156	12950	
	62207	24647	26663	23603	8294	(17)

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length 12:

24584	37973	93149	119366	74846	
59399	180515	39020	59324	63473	
26093	67100				(2)

length 22:

9045	63198	99837	167916	91410	
60075	27708	66414	17601	24585	
40074	18855	71787	83190	92061	
66858	84213	34068	41811	33795	
79467	101463				(3)

length 28:

70225	19996	184924	93898	183877	
99394	178414	51625	14059	63199	
126118	40579	80005	35893	95428	
95998	21304	1300	244	2080	
32800	33043	1753	20176	24616	
16609	74602	25639			(7)

The numbers with brackets denote first natural numbers appeared as cyclic parts.

Therefore we have 15 cyclic parts: five cyclic parts with length 1, three cyclic parts with length 2, one cyclic part with length 4, one cyclic part with length 6, two cyclic parts with length 10, one cyclic part with length 12, one cyclic part with length 22, and one cyclic part with length 28.

References

[1] K. Chikawa, K. Iséki and T. Kusakabe, *On a problem by H. Steinhaus*, Acta Arith. this volume, pp. 251-252.

[2] K. Iséki, *Necessary results for computation of cyclic parts in Steinhaus problem*, Proc. of Japan Academy 36 (1960), pp. 650-651.

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On the distribution of prime ideals

by

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Introduction

1. In 1944 Linnik (see [13]) proved the existence of an absolute constant $c > 0$ such that the least prime in any arithmetical progression $Du+l[(D,l)=1, u=0,1,\ldots]$ does not exceed D^c. In 1954 Rodosskiĭ [15] gave a shorter proof of the same theorem. In 1955 I proved [3] the existence of an absolute constant $c>0$ such that there is at least one prime $p\equiv l\,(\mathrm{mod}\,D)$ with $(D,l)=1$ in the interval (x, xD^c) for any $x\geqslant 1$ [1]. It is the aim of the present paper to prove an analogous result for an algebraic field as stated in the following

Theorem. *Let K, $\mathfrak{f}$, $\mathfrak{H}$ denote respectively any algebraic field of degree $n\geqslant 1$, any ideal in K and any class of ideals modulo $\mathfrak{f}$. Further let*

$$D = |\Delta|\cdot N\mathfrak{f} > 1\,,$$

where Δ denotes the discriminant of the field and $N\mathfrak{f}$ the norm of $\mathfrak{f}$. Then there is a positive constant c (which depends on n only) such that for all $x\geqslant 1$ in the interval (x, xD^c) there is at least one prime p representing the norm of a prime ideal $\mathfrak{p}\in\mathfrak{H}$.

In particular for $n=1$, $\mathfrak{f}=[D]$ we get the result concerning primes $p\equiv l\,(\mathrm{mod}\,D)$ as stated above. Taking $n>1$, $x=1$, $\mathfrak{f}=\mathfrak{o}$ (the unit ideal) we deduce that *in any class of ideals* (in the usual sense) *there is a prime ideal $\mathfrak{p}$ with the norm $\leqslant |\Delta|^c$.*

Taking $n=2$, $\mathfrak{f}=[k]$ (k any natural number $\geqslant 1$) we deduce the existence of a prime $p_\varphi\in(x, xD^c)$ *representable by the prescribed primitive binary quadratic form φ* with the discriminant Δk^2, where Δ is a fundamental discriminant and $D=|\Delta|k^2$. For $\Delta<0$ only positive forms are considered. See further §§ 3 and 6-8, where the statement will be improved for intervals (x, xD^ε) $(0<\varepsilon\leqslant c,\ D\geqslant D_0(\varepsilon),\ x\geqslant D^{c'\log(c/\varepsilon)})$.

[1] In 1960 I improved (see [4]) this theorem for intervals (x, xD^ε), $0<\varepsilon\leqslant c$, $D\geqslant D_0(\varepsilon)$, $x\geqslant D^{c'\log(c/\varepsilon)}$.