CHAPTER 3

Decisive solution to the problem of forming tables concerning divisors of composite numbers by regular loops in arithmetic progressions and successive cycles

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Forming the "H.M"[1] tables using regular loops in arithmetic progression

Forming a decisive solution for the problem of defining the prime factors of composite numbers and recognition of prime numbers using the table, 3 tables will be designed and described.

Each one of these tables has special quality, so that they can be formed by numbered order loops with out division. Now we will explain every one of these tables.

3.1. "H.M" matrix table (zero and one) for recognizing prime numbers and divisors of composite numbers

For forming this table we write odd numbers in one row and write the prime number in a column on paper. According to division law, we form a matrix of "1" and "0", with this condition that if each row number is divisible to column numbers, we put "1" in their junction and if not divisible we put "0" in their junction. In this case, a matrix of "1" and "0" will be formed so that if in each column only "1" exists , that number is prime, and if in each column concerned to row number, there are more than one "1", that number is composite. This table is very reliable and it is programmable by computer and in this table all of the considered number’s factors are determined, because the number "1" will be repeated in the number of factors of a supposed number.

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1. H.M: author’s works.

Table – H.M (I)

n	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53
3	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
5	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0
7	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
9	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
17	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
19	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

3.2. "H.M" Loop table for recognizing prime numbers and divisors of composite numbers

This table consists of one general columns and one general row. This table gives the factors of each composite number which is coprime with 2, 3 and 5. We know that prime numbers are ended to the numbers 1,3,7,9. In the table there are 4 general loops according to unit digit of each prime number. In this table only unit digits are as loops.

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The loops are formed as below:

(7) Loop of prime numbers that is ended to digit "7":
(9-3-7-1-5)

9	a	3	b	7	c	1	d	5	e

(11) Loop of prime numbers that is ended to digit "1":
(1-3-5-7-9)

1	p	3	q	5	r	7	s	9	t

(13) Loop of prime numbers that is ended to digit "3":
(9-5-1-7-3)

9	m	5	n	1	k	7	u	3	v

(19) Loop of prime numbers that is ended to digit "9":
(1-9-7-5-3)

1	f	9	g	7	h	5	L	3	w

3.2.1. Note

For the next prime number, the distance between two numbers of each loop will increase. In the main row, unit digit is not written and we put the symbol □ instead of it. Instead of □, every digit of this column can be located. For identifying the factors of a composite number, it is enough to look at the number of one– digit number of its column.

Prime factors of that composite numbers are determined from junction of repeated number of its column with row of prime number.

If in the column of a supposed number, there is not any one-digit number, that number is a prime number with digit of this number.

3.2.2. Attention

We can continue this table with loops as much as we want and find table of factor of numbers (tables are in 10-aced from).

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Table – H.M (II)

	23	19	14	13	11	7	3	p
								9
							5	1 □
							1,7	2 □
							3,9	3 □
						9	5	4 □
							1,7	5 □
						3	3,9	6 □
						7	5	7 □
							1,7	8 □
						1	3,9	9 □
						5	5	10 □
						9	1,7	11 □
					1		3,9	12 □
						3	5	13 □
					3	7	1,7	14 □
							3,9	15 □
				9	5	1	5	16 □
						5	1,7	17 □
					7	9	3,9	18 □
				5			5	19 □
					9	3	1,7	20 □
						7	3,9	21 □
				1			5	22 □
					1	1	1,7	23 □
				7		5	3,9	24 □
					3	9	5	25 □
							1,7	26 □
				3	5	3	3,9	27 □
			9			7	5	28 □
				9	7		1,7	29 □
						1	3,9	30 □
					9	5	5	31 □
			3	5		9	1,7	32 □
							3,9	33 □
					1	3	5	34 □
			7	1		7	1,7	35 □
		1			3		3,9	36 □
				7		1	5	37 □
					5	5	1,7	38 □
		9	1			9	3,9	39 □
				3	7		5	40 □
						3	1.7	41 □
			5	9	9	7	3,9	42 □

	23	19	14	13	11	7	3	p
		7					5	43 □
						1	1,7	44 □
			9	5	1	5	3,9	45 □
						9	5	46 □
		5			3		1,7	47 □
				1		3	3,9	48 □
			3		5	7	5	49 □
				7			1,7	50 □
		3			7	1	3,9	51 □
	9		7			5	5	52 □
				3	9	9	1,7	53 □
							3,9	54 □
		1		9		3	5	55 □
			1		1	7	1,7	56 □
	5						3,9	57 □
		9		5	3	1	5	58 □
			5			5	1,7	59 □
					5	9	3,9	60 □
				1			5	61 □
	1	7	9		7	3	1,7	62 □
				7		7	3,9	63 □
					9		5	64 □
						1	1,7	65 □
	7	5	3	3		5	3,9	66 □
					1	9	5	67 □
				9			1,7	68 □
			7		3	3	3,9	69 □
		3				7	5	70 □
	3			5	5		1,7	71 □
						1	3,9	72 □
			1		7	5	5	73 □
		1		1		9	1,7	74 □
	9				9		3,9	75 □
			5	7		3	5	76 □
.....	......	.....	.....	.....	....	.....	...	...
....	....	....	....	....	....	....	....	....

Note: The black parts are loops.

3.3. "H.M" Loop-cyclic table for recognizing prime numbers and divisors of composite numbers

This table has 9 rows that the distance of every two successive rows is "10". And the columns are added in the cycle of (+90). In this table row loops appear as column loops. For every 90-cycle one or two columns of prime numbers will be added. In the first column, numbers are as 1□, 2□, 3□, ..., 9□ that if every digit in its row doesn't exist in mentioned cycle that number is prime, and whenever a number is repeated several time in a row, in fact, the mentioned number has factors as that number.

3.3.1. Attentions

Loops are in column form and it will repeat as the previous form.
For example, for number 7 in this table:

(Loop 1)

1
5
9
□
3
7
□

(Loop 2)

1
5
9
□
3
7
□
⋮

For writing these numbers, it is enough to repeat the mentioned loops.

3.3.2.

We calculate residual of every number at first with "90" and we determine unit digit in its column.

3.3.3.

It is obvious that the row is determined from the congruence:

$$M \overset{90}{\equiv} r$$

and we can calculate the column related to this cycle from $H = \left\lfloor \frac{M}{90} \right\rfloor + 1$. This is the briefest, fastest and the most reliable table for writing and to continue that it is enough to consider the cycles and loops.

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3.3.4.

In general for determining the number "*M*" from the table loop-cycle it is enough to do the following division:

$$\begin{array}{r|l} M & 90 \\ \hline & q \\ \underline{N} & \\ r & \end{array}$$

In this case, the number "$H = q + 1$" shows cycle and "r" shows the row related to "*M*". For example, the number "$M = 983^n$" is equivalent with the couple
M = (11, 8③). Because the number "3" is not in the 8th row of the 11th cycle, so, the number "983" is prime.

$$\begin{array}{r|l} 983 & 90 \\ \hline & 10 \\ \underline{900} & \\ 8③ & \end{array}$$

$, H = q + 1 = 10 + 1 = 11$ (11 : number of cycle)

r = 8③ (8: number of row)

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Table Loop-Cycle-H.M (III)

	+90						+180				+270						+360						+450							+540						
	Cycle 1		Cycle 2				Cycle 3				Cycle 4						Cycle 5						Cycle 6							Cycle 7						
	3	7	3	7	11	13	3	7	11	13	3	7	11	13	17	19	3	7	11	13	17	19	3	7	11	13	17	19	23	3	7	11	13	17	19	23
1 □	5		5	5			5			5	5	7			9		5	1		7			5	9						5	3		9		1	
2 □	1,7	1	1,7	9			1,7	3	9		1,7		7	9			1,7	5	5				1,7		3			5		1,7	7	1		1		
3 □	3,9	5	3,9		1		3,9	7			3,9	1					3,9	9			1	9	3,9	3		1				3,9						5
4 □	5	9	5	3			5			1	5	5	9				5		7	3			5	7	5		3			5	1	3	5		1	
5 □	1,7		1,7	7	3		1,7	1	1		1,7	9		5	3		1,7	3					1,7			7				1,7	5			5		
6 □	3,9	3	3,9				3,9	5		7	3,9						3,9	7	9	9	5		3,9	1	7			3		3,9	9	5				
7 □	5	7	5	1	5	9	5	9	3		5	3	1				5					7	5	0			7		9	5			1			
8 □	1,7		1,7	5			1,7				1,7	7	1	1	7		1,7	1					1,7	9	9	9				1,7	3	7		9	7	1
9 □	3,9	1	3,9	9	7		3,9	3	5	3	3,9		3			1	3,9	5	1	5	9		3,9							3,9	7		7			

	+630							+720							+810								+900									+990									
	Cycle 8							Cycle 9							Cycle 10								Cycle 11									Cycle 12									
	3	7	11	13	17	19	23	3	7	11	13	17	19	23	3	7	11	13	17	19	23	29	3	7	11	13	17	19	23	29	31	3	7	11	13	17	19	23	29	31	...
1 □	5		9					5	5	7		1			5		5						5	7	3							5	1	1	1		7				
2 □	1,7	1						1,7	9		1		1		1,7	3			3				1,7			3	1					1,7	5						5		
3 □	3,9	5		3	3	5	7	3,9		9				9	3,9	7	7	5				1	3,9	1	5			1				3,9	9	3	7	3				3	
4 □	5	9	1					5	3		7	5			5					5	1		5	5		9			3			5						5			
5 □	1,7			9				1,7	7				9		1,7	1	9		7				1,7	9	7		5			7		1,7	3	5			5				
6 □	3,9	3	3		7			3,9		1					3,9	5		1					3,9					9			1	3,9	7		3	7					
7 □	5	7				3		5	1		3	9			5	9							5	3	9	5						5		7							
8 □	1,7		5	5			3	1,7	5	3				5	1,7		1	7		3	7	9	1,7	7			9		9			1,7	1		9				3		
9 □	3,9	1						3,9	9		9		7		3,9	3			1				3,9									3,9	5	9			3	1		5	

Note: The black parts are loops.

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