Society for Science and Education
United Kingdom

TNC Transactions on Networks and Communications

Volume 5, No. 3
ISSN: 2054 -7420

Seven Cool Number Patterns

Mohammed R. Karim
Alabama A&M University, Normal, Alabama, USA
mohammed.karim@aamu.edu

ABSTRACT

Inspired by a number pattern found while reading an online newspaper seven number patterns are created. Behind each pattern there is a distinct algorithm. Some of these patterns are a sequence of a single or double digit, and the rest are packing ups of one or two digits either one or both sides of a particular number. An interpretation of the inspiring number pattern is also provided.

Keywords: Number Patterns, Transpose, Packing.

1 Introduction

While reading an online news paper from abroad, I found the following number pattern.

$$1\times 8+1=9$$

$$12\times 8+2=98$$

$$123\times 8+3=987$$

$$1234\times 8+4=9876$$

$$12345\times 8+5=98765$$

$$123456\times 8+6=987654$$

$$1234567\times 8+7=9876543$$

$$12345678\times 8+8=98765432$$

$$123456789\times 8+9=987654321$$

It captured my attention. I was fascinated by this amazing number pattern and trying to interpret it in the following way:

It, to me, defines a function f with the domain $\{1,2,3,4,5,6,7,8,9\}$ and as if, each of these digits occupy a box arranged in a row (Figure 1) and correspond another digit in the row by the following rules:

DOI: 10.14738/tnc.53.3386
Publication Date: 22nd June 2017
URL: http://dx.doi.org/10.14738/tnc.53.3386

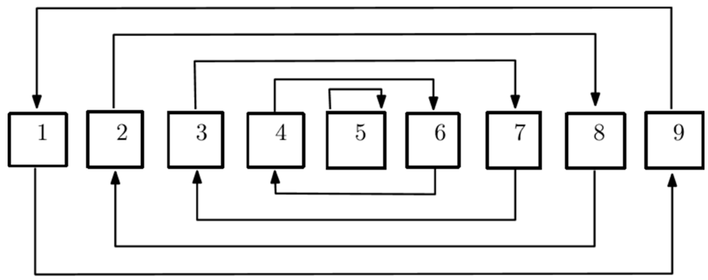

Figure 1

$$f(1) = [1]^T = 9 \text{ and } f(9) = [9]^T = 1$$

$$f(2) = [2]^T = 8 \text{ and } f(8) = [8]^T = 2$$

$$f(3) = [3]^T = 7 \text{ and } f(7) = [7]^T = 3$$

$$f(4) = [4]^T = 6 \text{ and } f(6) = [6]^T = 4$$

$f(5) = [5]^T = 5$, i.e., 5 corresponds to itself (symmetric).

This means, under this function:

The first box on the left marked by 1 corresponds to the last box on the right marked by 9.

The second box on the left marked by 2 corresponds the second box on the right marked by 8.

The third box on the left marked by 3 corresponds the third box on the right marked by 7.

The fourth box on the left marked by 4 corresponds the fourth box from the right marked by 6.

The box marked by 5 is in the middle and it corresponds to itself.

Moreover, the last line of the above number pattern shows that

$$f(123456789) = (123456789)^T = 987654321,$$

where T represents the 'Transpose of Digits' similar to the 'Transpose of Matrices' used in Linear Algebra [1]. For example:

$$(AB)^T = B^T A^T, \ (ABC)^T = C^T B^T A^T \text{ etc.}$$

where A, B, C are matrices of appropriate sizes (dimensions) so that the matrix multiplications

AB, ABC are defined. Hence one can think of the function f as a function that follows the 'Transposition Rule' as used in Linear Algebra.

Then I was thinking 'Can I create any such number patterns?' The following seven number patterns are the results of the thinking process.

2 Number Patterns

Pattern 1: Having 0, 1, 2, 3, 4, 5, 6 and 7 on the right of 7.

$$8 \times 8 + 6 = 70$$

$$87 \times 8 + 5 = 701$$

$$876 \times 8 + 4 = 7012$$

$$8765 \times 8 + 3 = 70123$$

$$87654 \times 8 + 2 = 701234$$

$$876543 \times 8 + 1 = 7012345$$

$$8765432 \times 8 + 0 = 70123456$$

$$87654321 \times 8 - 1 = 701234567$$

Pattern 2: Creating Odd Digits (1, 3, 5, 7, 9) on the right of 70

$$9 \times 7 + 6 + 10^0 = 70$$

$$98 \times 7 + 5 + 10^1 = 701$$

$$987 \times 7 + 4 + 10^2 = 7013$$

$$9876 \times 7 + 3 + 10^3 = 70135$$

$$98765 \times 7 + 2 + 10^4 = 701357$$

$$987654 \times 7 + 1 + 10^5 = 7013579$$

Pattern 3: Creating a Sequence of 9's

$$(9 \times 9 + 8) + 10^1 = 99$$

$$(99 \times 9 + 8) + 10^2 = 999$$

$$(999 \times 9 + 8) + 10^3 = 9999$$

$$(9999 \times 9 + 8) + 10^4 = 99999$$

$$(99999 \times 9 + 8) + 10^5 = 999999$$

$$(999999 \times 9 + 8) + 10^6 = 9999999$$

$$(9999999 \times 9 + 8) + 10^7 = 99999999$$

$$(99999999 \times 9 + 8) + 10^8 = 999999999$$

Pattern 4: Packing up 1's on the Left of 0

$$1\times 9+1=10$$

$$12\times 9+2=110$$

$$123\times 9+3=1110$$

$$1234\times 9+4=11110$$

$$12345\times 9+5=111110$$

$$123456\times 9+6=1111110$$

$$1234567\times 9+7=11111110$$

$$12345678\times 9+8=111111110$$

$$123456789\times 9+9=1111111110$$

Pattern 5: Packing up 1's on the Left and 8's on the Right of 0

$$3\times 3-1=8$$

$$33\times 33-1=1088$$

$$333\times 333-1=110888$$

$$3333\times 3333-1=11108888$$

$$33333\times 33333-1=1111088888$$

$$333333\times 333333-1=111110888888$$

$$3333333\times 3333333-1=11111108888888$$

Pattern 6: Creating a Sequence of 9's and 0's

$$9\times 9-1+10^{1}=90$$

$$99\times 99-1+10^{2}=9900$$

$$999\times 999-1+10^{3}=999000$$

$$9999\times 9999-1+10^{4}=99990000$$

$$99999\times 99999-1+10^{5}=9999900000$$

$$999999\times 999999-1+10^{6}=999999000000$$

$$9999999\times 9999999-1+10^{7}=99999990000000$$

$$99999999\times 99999999-1+10^{8}=9999999900000000$$

Pattern 7: Packing up 4's and 5's respectively on the Left and Right of 3

$$6\times 6-1=35$$

$$66\times 66-1=4355$$

$$666\times 666-1=443555$$

$$6666\times 6666-1=4435555$$

$$66666\times 66666-1=444355555$$

$$666666\times 666666-1=44443555555$$

$$6666666\times 6666666-1=4444435555555$$

$$66666666\times 66666666-1=444444355555555$$

$$666666666\times 666666666-1=44444443555555555$$

ACKNOWLEDGEMENT

I would like to thank my colleague Dr. Israel Ncube for his help in creating the Figure 1.

REFERENCES

[1] Poole, David, Linear Algebra-A Modern Introduction (4th Edition), Cengage Learning, 2015.