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Coding and Decoding of Multiple Factoriangular Numbers and its Application in Cryptographic System

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Abstract

In the modern age of technology, cryptography is becoming an essential topic in computer science. Security in modern cryptography is measured in the amount of computation it would take to decode the message. In this paper we have defined program for multiple factoriangular numbers for given values of (n, k) and also we have developed a program to find value of n for given multiple Factoriangular numbers taking k=2. Also we emphasize the application ofthis program in cryptography

Keywords: Cryptography • Multiple Factoriangular Numbers • Security • Algorithm

Introduction

Triangular number [1] is a number obtained by adding all positive integers less than or equal to a given positive integer n, i.e.

$T_n = n(n+1)/2$

Factoriangular number [2] is defined as the sum of the first n natural numbers plus the factorial of n. i.e.

$Ft_n = n(n+1)/2 + n!$

Cryptography was concerned with the conversion (encryption) of the message from anunderstandable form into meaningless one and reverse again at the other end so that the unauthorized person cannot read it without the information of secret key (decryption).

Multiple Factoriangular number

It is the generalisation of factoriangular numbers of the type,[3]

$\mathbf{F_t(n, k) = (n!)^k + \sum n^k}$

Program 1:C++ program to evaluate multiple factoriangular numbers for given values of n,k

```
#include <stdio.h>
#include <iostream>
#include <cmath>
using namespace std;
double factorial (double n)
{If (n==0 || n==1)return n;else return n*factorial (n-1) ;}double powersum (double n, double k)
{Double sum = 0; for (int I =1; I<=n;I++) sum += pow (i, k); return sum;}(Int main)
{int n,k;cout << "enter n" ;cin>> n;cout <<"enter k";cin>> k;double value = pow(factorial (n),k)+ powersum (n,k);cout<< value ;}
```

Program 2: C++ program to evaluate the value of n for given multiple factoriangular numbers for fixed k(k=2)

```
#include <stdio.h>[4]
#include <iostream>
#include <cmath>
Using namespace STD;double factorial (double n)
{If (n==0 || n==1)return n;else return n*factorial (n-1);}
Double powersum (double n, double k)
{Double sum = 0;for (int I =1; I<=n;I++)sum += POW (I, k);return sum ;} int main ()
{Int n, k;double a;cout << "enter a number";n=1;k=2;cin>> a;for (int I=1; I<=n;I++)
{Double value = POW (factorial (n), k) + powersum (n, k);
If(a == value)
```

Table 1. Assignment of ASCII value to the characters.

Original message	a	b	c	d	e	Space	x	y	z
ASCII value corresponding to each character	n1	n2	n3	n4	n5	n6	n7	n8	n9

Table 2. Addition of prime multiple factoriangular number for k=2 in the ASCII value.

Original message	**a**	**b**	**c**	**d**	**e**	**Space**	**x**	**y**	**z**
ASCII value corresponding to each character	n_1	n_2	n_3	n_4	n_5	n_6	n_7	n_8	n_9
Prime multiple factoriangular number	2	2	2	2	2	2	2	2	2
Adding both	$n_1' = n_1+2$	$n_2' = n_2+2$	$n_3' = n_3+2$	$n_4' = n_4+2$	$n_5' = n_5+2$	$n_6' = n_6+2$	$n_7' = n_7+2$	$n_8' = n_8+2$	$n_9' = n_9+2$

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Table 3. Assignment of multiple factoriangular number to each n=ni' , k=2.

Original message	a	b	c	d	e	Space	x	y	z
N	n_1'	n_2'	n_3'	n_4'	n_5'	n_6'	n_7'	n_8'	n_9'
K	2	2	2	2	2	2	2	2	2
Corresponding multiple factoriangular number	d_1'	d_2'	d_3'	d_4'	d_5'	d_6'	d_7'	d_8'	d_9'
Digit representatiom of d_i'	$d_{11}d_{12}d_{13}\ldots$	$d_{21}d_{22}d_{23}\ldots d_2e_2$	$d_{31}d_{32}d_{33}\ldots d_3e_3$	$d_{41}d_{42}d_{43}\ldots d_4e_4$	$d_{51}d_{52}d_{53}\ldots d_5e_5$	$d_{61}d_{62}d_{63}\ldots d_6e_6$	$d_{71}d_{72}d_{73}\ldots d_7e_7$	$d_{81}d_{82}d_{83}\ldots d_8e_8$	$d_{91}d_{92}d_{93}\ldots d_9e_9$
	d_1e_1								

Table 4: String of the value of n corresponding to each multiple factoriangular number taking k=2.

Mutiple Factoriangular Numbers	d_1'	d_2'	d_3'	d_4'	d_5'	d_6'	d_7'	d_8'	d_9'
K	2	2	2	2	2	2	2	2	2
N	n_1'	n_2'	n_3'	n_4'	n_5'	n_6'	n_7'	n_8'	n_9'

Table 5. String of number after substracting prime multiple Factoriangular number.

Mutiple Factoriangular Numbers	d_1'	d_2'	d_3'	d_4'	d_5'	d_6'	d_7'	d_8'	d_9'
N	n_1'	n_2'	n_3'	n_4'	n_5'	n_6'	n_7'	n_8'	n_9'
K	2	2	2	2	2	2	2	2	2
String of numbers after subtraction	$n_1=n_1'-2$	$n_2=n_2'-2$	$n_3=n_3'-2$	$n_4=n_4'-2$	$n_5=n_5'-2$	$n_6=n_6'-2$	$n_7=n_7'-2$	$n_8=n_8'-2$	$n_9=n_9'-2$

Table 6. ASCII value corresponding to each number of the string.

String of Numbers	n_1	n_2	n_3	n_4	n_5	n_6	n_7	n_8	n_9
ASCII character	a	b	c	d	e	Space	x	y	z

{Cout<< "Entered no. Is factorials no for k=2 and n= "<<n ;}else {n=n+1 ;}}} (Tables 1-7).

Conclusion

Cryptography is used to ensure that the content of message are transmitted confidentially and the content cannot be changed.The main aim of the paper was to propose and implement an algorithm to meet the essential requirement of cryptography.

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