

Real Numbers with Binomial Coefficients of Geometric Series

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Abstract: This paper presents a method to calculate the binomial coefficients with real numbers. This idea can enable the scientific researchers to solve the real world problems.

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1. Introduction

A geometric series with binomial coefficients [1-17] is derived from the multiple summations of a geometric series [17-27]. The binomial coefficient V_n^r is defined as a coefficient of x^k in the geometric series $\sum_{i=0}^n x^i$.

Let us see the geometric series with binomial coefficients that is derived from the multiple summations of a geometric series [28-40].

$$\sum_{i_1=0}^n \sum_{i_2=i_1}^n \sum_{i_3=i_2}^n \cdots \sum_{i_r=i_{r-1}}^n x^{i_r} = \sum_{i=0}^n V_i^r x^i \text{ and } V_n^r = \frac{(n+1)(n+2)(n+3) \cdots (n+r)}{r!},$$

where r is a positive integer and n is a non-negative integer.

Note that $V_n^0 = V_0^0 = 0! = 1$ and $V_0^r = \frac{(0+1)(0+2)(0+3) \cdots (0+r)}{r!} = \frac{r!}{r!} = 1$.

2. Binomial Coefficient with Real Numbers

The binomial coefficient with real number is introduced as follows:

$$V_x^r = \frac{(x+1)(x+2)(x+3) \cdots (x+r)}{r!},$$

where r is a positive integer, x is a non-negative real number, and V_x^r is a binomial coefficient.

Note that $V_x^0 = V_0^0 = 0! = 1$.

Examples for the binomial coefficient with real number are given below:

$$V_{0.451}^6 = \frac{(0.451+1)(0.451+2)(0.451+3)(0.451+4)(0.451+5)(0.451+6)}{6!}.$$

$$R_{\pi}^1 = \frac{(1+\pi)}{1!} = 1 + \frac{22}{7} \left(\because \pi = \frac{22}{7} \right).$$

$$V_{\sin 60^\circ}^4 = \frac{\left(\frac{\sqrt{3}}{2}+1\right)\left(\frac{\sqrt{3}}{2}+2\right)\left(\frac{\sqrt{3}}{2}+3\right)\left(\frac{\sqrt{3}}{2}+4\right)}{4!} \left(\because \sin 60^\circ = \frac{\sqrt{3}}{2} \right).$$

Similarly, we can constitute other binomial coefficients with real numbers.

Let us use both variables in a binomial coefficient V_x^y as real numbers, i.e. x and y are real numbers.

$$V_x^y = V_x^{i.f} = V_x^i + (V_x^{i+1} - V_x^i) \times f.$$

For example, $y = i.f = 3.7 = 3 + 0.7$ where 3 is the integer part and 0.7 the fraction part,

$$i.e., \quad V_x^{3.7} = V_x^3 + (0.7)(V_x^4 - V_x^3).$$

3. Conclusion

In this article, a technique has been introduced to computer a binomial coefficient with real number. This technique is used as application in computing and mathematical sciences.

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