

---

---

## APPLICATION OF MATHEMATICAL INDUCTION FOR INHERITANCE LAW INTERPRETATIONS

Assen Tochev, Vassil Guliashki

**Abstract:** *The purpose of this article is to obtain simple rule for applying the Inheritance law for the case of (own) brothers/sisters by birth, and/or brothers/sisters uterine or through father. Using the mathematical induction a result is obtained for  $n$  (own) brothers/sisters by birth and  $m$  brothers/sisters uterine or through father.*

**Keywords:** *Inheritance law, mathematical induction.*

**ACM Classification Keywords:** *A.0 General Literature - Conference proceedings; I. Computing methodologies, I.2. Artificial Intelligence, I.2.1. Applications and expert systems, Subject descriptor: Law; H. Information systems, H4. Information systems application, H.4.2. Types of systems, Subject descriptor: Decision support;*

---

### Introduction

---

Let us consider the following part from the Bulgarian inheritance law (see [Law of inheritance, 1949] and [Tassev et al, 2009]):

Article 8 (1) When the deceased has left only brothers and sisters, they inherit equal parts.

(2) When the deceased has left only brothers and sisters together with ascending in second or higher degree, the first obtain two thirds from the heritage and the last (the ascending) – one third.

(3) In the cases of foregoing clauses the brothers/sisters uterine and brothers/sisters through father obtain the half of the part inherited by the (own) brothers/sisters by birth.

(4) (New – State Newspaper, Nr. 60 since 1992) When the deceased has not left ascending in second or higher degree brothers and sisters or their descendents, inheritors are the relatives in collateral line till sixth degree inclusively. The closer by degree and the descending of one closer by degree excludes the more distant by degree relative.

### Cases of heritage separation according the Bulgarian Inheritance law

1. Case (0,0) – **zero** (own) brothers/sisters by birth, and **zero** brothers/sisters uterine or through father.

PROBLEM: Let there are no brothers/sisters and/or brothers/sisters uterine or through father, who inherit. Who will obtain the heritage?

SOLUTION:

From Article 8 (4) can be concluded, that when the legator has not brothers and sisters, the relatives in collateral line till sixth degree inclusively inherit.

2. Case (0,1) – **zero** (own) brothers/sisters by birth, and **one** brother/sister uterine or through father.

PROBLEM: Let there is one brother/sister uterine or through father, who inherits. How big part from the heritage will inherit the brother/sister uterine or through father?

SOLUTION:

Let the brother/sister uterine or through father inherits  $1/2$  part from the heritage, as prescribed in Article 8 (3), i.e.:

Iteration 1

The rest of heritage is  $Z_1=1/2$ . The obtained heritage is  $H_1=1/2$ .

Iteration 2

The rest of heritage is divided by 2:  $Z_2=1/4$ . The obtained heritage is  $H_2=1/2+1/4$ .

Iteration 3

The rest of heritage is divided by 2:  $Z_3=1/8$ . The obtained heritage is  $H_3=1/2+1/4+1/8$ .

Iteration 4

The rest of heritage is divided by 2:  $Z_4=1/16$ . The obtained heritage is  $H_4=1/2+1/4+1/8+1/16$ .

...

Iteration  $k$

The rest of heritage is divided by 2:  $Z_k=1/2^k$ . The obtained heritage is  $H_k=1/2+1/4+...+1/2^k$ .

$$\lim_{k \rightarrow \infty} (1/2^k) = 0 \quad (1)$$

Hence  $1/2+1/4+1/8+1/16+...+1/2^k = 1/2(1+1/2+1/4+...+1/2^{k-1}) =$

$=1/2((2^{k-1}+2^{k-2}+...+2^1+1)/2^{k-1}) =$

$=1/2(((2^{k-1}+2^{k-2}+...+2^1+1).(2-1))/((2-1)2^{k-1})) =$

$$=1/2((2^k-1)/2^{k-1}) = \text{taking into account (1)}$$

$$=1/2(2^k/2^{k-1}) =$$

$$=1/2 \cdot 2 =$$

$$=1$$

Hence, when only one brother/sister uterine or through father inherits, he/she obtains the whole heritage.

This conclusion can be drawn also by another way:

Let we denote by X the part of heritage inherited by the (own) brothers/sisters by birth, and by Y the part of heritage inherited by the brothers/sisters uterine or through father. Then according Article 8 (1) and Article 8 (3) the following system of linear equations can be created:

$$X+Y=1$$

$$X=0$$

$$Y=1$$

3. Case (1,0) – **one** (own) brothers/sisters by birth, and **zero** brother/sister uterine or through father.

PROBLEM: Let there is one (own) brother/sister by birth and zero brothers/sisters uterine or through father, who inherit. How big part of the heritage will inherit the brother/sister by birth and the brothers/sisters uterine or through father?

SOLUTION:

Using X and Y as denoted in the previous case we create the following system of linear equations according Article 8 (1) and Article 8 (3):

$$X+Y=1$$

$$Y=0$$

$$X=1$$

Hence according Article 8 (1), when only one (own) brother/sister by birth inherits, he/she will obtain the whole heritage.

4. Case (1,1) – **one** (own) brothers/sisters by birth, and **one** brother/sister uterine or through father.

PROBLEM: Let there is one (own) brother/sister by birth and one brother/sister uterine or through father, who inherit. How big part of the heritage will inherit the brother/sister by birth and the brothers/sisters uterine or through father?

SOLUTION:

According Article 8 (1) and Article 8 (3) we create the following system of linear equations:

$$X+Y = 1$$

$$Y = (1/2).X$$

Hence:

$$X+(1/2).X = 1$$

$$(3/2).X = 1$$

$$X = 2/3$$

$$Y = 1/3$$

It means that the brother/sister by birth obtains 2/3 from the heritage and the brother/sister uterine or through father – 1/3.

Now we will prove a simple rule for applying the Bulgarian Inheritance law in case of  $n$  (own) brothers/sisters by birth and  $m$  brothers/sisters uterine or through father by means of method of mathematical induction (see [Knuth, 1997]).

### Common rule obtained through mathematical induction

Let we have  $n$  (own) brothers/sisters by birth and  $m$  brothers/sisters uterine or through father.

We denote the part of heritage obtained by each brother/sister by birth by  $U$ . The part of heritage obtained by each brother/sister uterine or through father is denoted by  $V$ .

**Statement 1:** In the case of  $n$  brothers/sisters by birth each of them will inherit  $U=X/n$  part of heritage.

**Statement 2:** In the case of  $m$  brothers/sisters uterine, each of them will inherit  $V=Y/m$  part of heritage.

We will prove *Statement 1* by means of mathematical induction.

#### **Proof of Statement 1:**

1) Let we have  $n = 1$  brother/sister by birth. Then according the Case 3 he/she will obtain the whole heritage, i.e. the inherited part  $U$  is:  $U = X/1$ .

2) We assume that the Statement 1 is true for  $n = k$ .

We have  $X = k.U$ , or  $U = X/k$ .

3) We consider the case with  $n = k+1$  brothers/sisters by birth.

Taking into account 2)  $X = k.U + U = U.(k+1)$ .

Hence  $U = X/(k+1)$ . ■

The Statement 2 can be proved by means of mathematical induction in a similar way.

---

## Conclusion

---

Let the brothers/sisters by birth, and/or the brothers/sisters uterine or through father are  $n$  and  $m$  correspondingly. In all cases, when  $n > 0$  and  $m > 0$ , the part of the heritage, obtained by the corresponding brothers/sisters is equal to  $X/n$  and  $Y/m$  correspondingly.

In the same way similar rules for inheritance laws interpretations in other countries can be proved. The obtained rules can be used in artificial intelligence systems for expert consultations in the area of inheritance law.

---

## Bibliography

---

- [Law of inheritance, 1949] Law of inheritance, in effect since 30.04.1949, published in State Journal Nr. 22 as of January 29. 1949, corrected in State Journal Nr. 41 as of February 21. 1949, changed in State Journal Nr. 275 as of November 1950, changed in State Journal Nr. 41 as of May 28. 1985, changed in State Journal Nr. 60 as of July 24. 1992, changed in State Journal Nr. 21 as of March 12. 1996, changed in State Journal Nr. 104 as of December 6. 1996, completed in State Journal Nr. 117 as of December 10. 1997, completed in State Journal Nr. 96 as of November 5. 1999, changed in State Journal Nr. 34 as of April 25. 2000, changed in State Journal Nr. 59 as of July 20. 2007, changed in State Journal Nr. 47 as of June 23. 2009;
- [Tassev et al, 2009] Tassev Ch., G. Petkanov, S. Tassev, Bulgarian Inheritance Law, Ninth overworked issue, Ciela, 2009.
- [Knuth, 1997] Knuth, Donald E., The Art of Computer Programming, Volume 1: Fundamental Algorithms (3rd ed.). Addison-Wesley, 1997, ISBN 0-201-89683-4. (Section 1.2.1: Mathematical Induction, pp. 11–21.)

---

## Authors' Information

---



**Assen Tochev** – *Institute of mathematics and informatics - BAS, "Acad. G. Bonchev" Str. Bl. 8, Sofia-1113, Bulgaria; e-mail: tochevassen@yahoo.com*

*Major Fields of Scientific Research: Artificial intelligence systems, Legal informatics, Decision and information systems*



**Vassil Guliashki** – *Doc. Ph.D., Institute of Information and Communication Technologies - BAS,*

*"Acad. G. Bonchev" Str. Bl. 2, Sofia-1113, Bulgaria; e-mail: vggul@yahoo.com*

*Major Fields of Scientific Research: Discrete optimization, Evolutionary algorithms, Global heuristic strategies, Multiple objective programming, Decision support systems*