Application of Mathematical Induction for Inheritance Law Interpretations

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

Keywords: *Inheritance law, mathematical induction.*

I. Introduction

Let us consider the following part of Bulgarian inheritance law [1] (see also [2]):

(1) Article 8. 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 half of the part inherited by the (own) brothers/sisters by birth.

(4) (New – State Newspaper, No 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.

II. Cases of heritage separation according to the Bulgarian Inheritance Law

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

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

SOLUTION. From Article 8 (4) it can be concluded, that when the legator has not any brothers or 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 a father

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

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

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

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

(1) $$\lim_{k\to\infty} (1/2^k) = 0.$$

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

taking into account (1) we obtain
$$(1/2)(2^k/2^{k-1}) =(1/2). 2 =1.$$

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

This conclusion can be drawn also by another way.

Let us denote by X the part of heritage inherited by the (own) brothers/sisters by birth, and by Y the part of heritage inherited by brothers/sisters uterine or

through a father. Then according to 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 a father.

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

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

$$X + Y = 1,$$
$$Y = 0,$$
$$X = 1.$$

Hence, according to 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 a father

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

SOLUTION. According to 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 a 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 a father by means of a method of mathematical induction [3].

III. Common rule obtained with the help of mathematical induction

Let us have n (own) brothers/sisters by birth and m brothers/sisters uterine or through a 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 a 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 the heritage.

We prove Statement 1 by means of mathematical induction.

Proof.

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

2) We assume that Statement 1 is true for $n = k$.
Then 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, $U = X/(k+1)$. ■

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

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

IV. Conclusion

Let the brothers/sisters by birth, and/or the brothers/sisters uterine or through a 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.

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Применение метода математической индукции для интерпретации закона о наследстве

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