What is Landes's arithmetic. In [1], Juergen Landes proposed a new arithmetic formalism, in which, in contrast to the usual arithmetic, the product of two negative numbers is negative: \((-a) \times (-b) = -ab\) when \(a > 0\) and \(b > 0\).

This new formalism has many interesting mathematical properties. Because of this, [1] asked for possible interpretation of this new arithmetic. This talk provides such an interpretation.

Main idea behind the interpretation. Multiplication is a natural operation in investments: if we invest an amount \(a\) into some financial instrument (stocks, bonds, etc.), then, at the end of investment period, we get an amount \(k \times a\), where \(k\) takes into account the rise (or fall) in stock prices, interest rate, etc.

This is a classical high school example of using a power function: if we place the amount \(a\) in a bank that pays \(r\) percent interest, then

- next year, we have the amount \(k \times a\), where \(k = 1 + r / 100\),
- in \(n\) years, we have the amount \(k^n \times a\).

These calculations, however, do not distinguish between money obtained by legal or illegal ways, and between legal and illegal investments. A natural idea is to mark the original amount \(a\):

- as positive if it comes from legal sources, and
- as negative if it comes from illegal sources.

Similarly, mark the coefficient \(k\) as positive if it corresponds to a legal investment and as negative if it corresponds to an illegal investment.
This interpretation explains Landes's multiplication. In this interpretation, the only way for the product $k \times a$ to be positive – i.e., legal – is when both the source of money is legal and the investment is legal, i.e., when both $k$ and $a$ are positive.

If one or both of the values $k$ and $a$ are negative, i.e., if at some point, law was violated, then the whole resulting amount $k \times a$ is illegal – i.e., negative. This is exactly Landes's multiplication.

What about addition? This way, we can also get a different addition operation: e.g., if someone got amount $a$ from a legal source and an amount from an illegal source, then this person’s total amount is $a + b$, and this total amount is not purely legal. In other words, similarly to what [1] proposes for multiplication, the sum $a + b$ is positive only if both numbers $a$ and $b$ are positive. In all other cases, the sum is negative and it is equal to $-(|a| + |b|)$.

What about subtraction? With subtraction, the situation is similar: if one has an amount $a$, and donated the amount $b$, then this person is left with the amount $a - b$. Here too, if the original amount was obtained by illegal means, and the person donated it to a good course, the remainder is still illegal (the "Godfather III" movie notwithstanding). Similarly, if the amount was legal, but the person donated the amount $b$ to an illegal organization (e.g., to support his/her favorite eco-terrorist group), the resulting amount is tainted and thus illegal.

Of course, this only applies to the case when donation $b$ was caused by an illegal act of the donator: if somewhat simply steals an amount $b$ from a legal amount $a$, the difference $a - b$ remains legal.

Caution. This interpretation of subtraction can only be applied to the case when the remainder is positive: otherwise, if someone donates more than he/she owns, then he/she ends up owing money, which is usually indicated by the negative balance $a - b$.

Division. With division by an integer or by a positive number, we can handle it the same way: take a portion of the original amount. If the original amount is was legal, the portion remains legal; if the original amount was illegal, the portion remains illegal.
Division by a non-integer number means unequal division: e.g., two-third goes to one person, one-third to another person.

This naturally leads to an extension to negative numbers: if something cannot be legally divided, but is divided illegally (e.g., if legal heirs hide the actual will and generate a fake will), then we get illegal results. For example, dividing 100 dollars illegally between two folks leads to two illegal amounts of 50: 100 / (-2) = -50. Here too, a / b is legal (positive) if and only if both a and b are positive.

Acknowledgments. The author is greatly thankful to Juergen Landes for valuable comments.

References
МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

Федеральное государственное бюджетное образовательное учреждение
высшего образования
ОМСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ
им. Ф.М. ДОСТОЕВСКОГО

МАТЕМАТИЧЕСКОЕ И КОМПЬЮТЕРНОЕ
МОДЕЛИРОВАНИЕ

Сборник материалов
IX Международной научной конференции,
посвященной 85-летию профессора В.И. Потапова

(Омск, 19 ноября 2021 г.)

© ФГБОУ ВО «ОмГУ им. Ф.М. Достоевского», 2021


Омск
ИЗДАТЕЛЬСТВО
ОМСКОГО ГОСУДАРСТВЕННОГО
УНИВЕРСИТЕТА

2021


В настоящий сборник включены тезисы докладов, прислан-ные на IX Международную научную конференцию «Математическое и компьютерное моделирование». Она состоялась на факуль-тах компьютерных наук ОмГУ им. Ф.М. Достоевского 19 ноября 2021 г. и была посвящена 85-летию профессора В.И. Потапова.
Для магистрантов, аспирантов и научных работников.


© Оформление. ФГБОУ ВО «ОмГУ им. Ф.М. Достоевского», 2021