

The Judicial Application of Algorithms in Calculating Awl in Inheritance under Algerian Family Law: A Case Study Using MATLAB

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Abstract:

This article focuses on the digital processing of 'Awl cases in inheritance, as established by Islamic law and codified in the Algerian Family Code. It presents the development of a precise computational algorithm using MATLAB software. The study aims to facilitate and accelerate the settlement of estates that involve 'Awl situations-where the total of the assigned shares exceeds the estate's value-by proportionally redistributing the shares among

heirs. Given the complexity and susceptibility to human error in manual 'Awl calculations, the proposed algorithm offers a practical and accurate tool that can be utilized by judges, notaries, and students of law and Sharia. The study does not delve into detailed jurisprudential discussions; rather, it concentrates on the technical and applied aspects, seeking to bridge legal knowledge with algorithmic computation, as part of an effort to integrate programming tools into the service of Islamic legal justice.

Keywords: Awl; Algerian Family Law; Estate Distribution; Inheritance Algorithms; MATLAB.

Introduction:

The inheritance system is one of the foundational pillars of the Algerian legal framework. The Algerian legislator has incorporated into the Family Code the provisions of Islamic law, as derived from Islamic jurisprudence, to organize the distribution of estates among heirs in a manner that ensures justice and preserves rights. Among the key mechanisms governing this distribution is the doctrine of 'Awl, which addresses situations in which the sum of the prescribed shares exceeds the estate's total value. In such cases, the shares of heirs are proportionally reduced to match the available assets, ensuring that no heir is denied their rightful portion.

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The subject of estate liquidation in accordance with the doctrine of 'Awl has received significant attention in both legal and jurisprudential literature. However, the use of algorithms to address inheritance issues remains a relatively new field in legal research. Given the complexity and precision required in the calculations involved in 'Awl cases-which can be difficult and time-consuming when done manually-there is a growing need to harness modern technologies to simplify and accelerate these processes.

This study arises from this context and aims to bridge two key dimensions:

- *The jurisprudential and legal dimension, as reflected in Islamic jurisprudence and Algerian Family Law;*
- *The technical dimension, represented by the design of a mathematical algorithm implemented through the MATLAB program⁽¹⁾.*

This algorithm seeks to offer a practical and accurate tool that can assist judges, notaries, legal scholars, and students of law and Sharia in addressing 'Awl cases, while still emphasizing the importance of understanding the religious and legal foundations that underpin the inheritance system.

It is important to clarify that an algorithm is a structured set of steps used to solve a particular problem, such as calculating the shares of heirs in 'Awl cases. MATLAB is a powerful software application used to implement these algorithms with accuracy and speed. It is not, in itself, an algorithm but a platform for executing them.

Accordingly, the significance of this study lies in its attempt to link the legal framework governing 'Awl in Algerian legislation with the technical dimension of accurate inheritance calculations. The goal is to produce a reliable method that facilitates estate distribution efficiently, especially in complex cases.

This study also contributes to filling a research gap, given the scarcity of studies that explore the intersection of inheritance law and programming in Algeria or in the broader Arab region.

The research is limited to the doctrine of 'Awl and does not address the concept of radd (return) in detail. It also focuses solely on Algerian Family Law without engaging in comparative analysis with other Arab legal systems.

Additionally, the study deliberately avoids citing Quranic verses and Hadiths, to prevent potential errors in translation or interpretation.

Nonetheless, it affirms that the doctrine of 'Awl is fundamentally based on Islamic legal texts, which served as the primary reference for the Algerian legislator in codifying inheritance rules.

Given the advanced computational capabilities of MATLAB, a custom algorithm was developed to calculate 'Awl inheritance cases accurately, and its steps are explained in a clear and simplified manner.

The purpose of this article is to present a practical tool that can assist notaries, judges, law and Sharia students, and professionals in the legal and religious fields in addressing 'Awl-related inheritance matters. The use of such a tool does not negate the need to study the science of inheritance ('ilm al-farā'id) and its detailed rulings; rather, it complements traditional knowledge by minimizing human error and accelerating computations, particularly in complex or numerically intensive cases. In this way, the article aims to combine precision and efficiency in estate distribution, while maintaining the importance of understanding the legal and religious foundations of inheritance law.

It is important to note that this paper does not seek to delve into the detailed jurisprudential discussions or doctrinal differences regarding the concept of 'Awl. Rather, its primary focus lies in the technical and computational aspect-specifically, the development and implementation of an algorithm capable of performing inheritance calculations based on 'Awl, in accordance with the Algerian Family Code, using MATLAB programming.

Although the rules of Awl are clearly defined in Islamic jurisprudence and Algerian Family Law, the calculations involved remain intricate and may lead to errors in estate settlement-especially in complex cases.

This study poses the following central question:

Can modern algorithms and software tools, such as MATLAB, be used to facilitate the calculation of 'Awl inheritance cases and ensure their accuracy and efficiency, without overlooking the importance of understanding the legal and religious principles governing inheritance?

To answer this question, the study adopts the following approaches:

- *Descriptive and analytical method: by examining the doctrine of 'Awl in Islamic jurisprudence and comparing it to the provisions of Algerian Family Law;*

- *Applied method: by designing a MATLAB-based algorithm to automatically calculate 'Awl cases and testing it on real-life examples to verify its consistency with traditional computations.*

The study combines both theoretical analysis, dealing with the rules of 'Awl, and practical application, through programming. It is structured into two main parts:

- *Section I: The Theoretical Framework of the Doctrine of 'Awl under Algerian Family Law,*
- *Section II: Applications of 'Awl and Its Impact on the Heirs' Shares-Between Traditional Calculation and Digital Processing.*

Section I: The Theoretical Framework of the Doctrine of Awl under Algerian Family Law

The inheritance system is one of the most significant legal and religious frameworks that govern the transfer of financial rights following the death of the deceased. It serves to preserve family bonds and ensure justice among heirs. Islamic jurisprudence is distinguished by its precise rules for estate distribution, among which is the doctrine of 'Awl-a legal mechanism designed to resolve situations where the prescribed shares of heirs exceed the estate's base value, thus ensuring that no rightful heir is deprived of their share.

The Algerian legislator has explicitly adopted this system in the Family Code⁽²⁾, aiming to address practical challenges that may arise during the division of estates, particularly when there is a discrepancy between the legally defined shares and the actual value of the estate. The significance of studying 'Awl lies in its combination of detailed jurisprudential rulings and complex mathematical calculations, making it a fertile ground for the integration of digital tools such as software programs and algorithms to simplify and accurately determine inheritance shares.

In this context, the study of the doctrine of 'Awl under Algerian Family Law holds particular importance-both in terms of its legal and jurisprudential foundations and its practical implementation-especially in light of the potential for digital processing to enhance justice and reduce errors in inheritance distribution.

A) subtitle: Definition of Awl:

The doctrine of 'Awl is regarded as one of the more intricate concepts in the science of inheritance ('ilm al-farā'id), as it pertains to the regulation of estate distribution among heirs in a manner that

ensures justice and protects rights as established by both Sharia and the law.

To properly understand this system, it is necessary to begin by clarifying the concept of 'Awl from its linguistic, terminological, jurisprudential, and legal perspectives, in order to grasp its nature and impact on the distribution of the estate.

- Linguistically, the term 'Awl denotes "increase." It is said, 'ālat al-mas'ala ("the case has undergone 'Awl") when the prescribed shares exceed the total value of the estate⁽³⁾.
- In Islamic jurisprudence, 'Awl refers to an increase in the total fractional shares⁽⁴⁾ allocated to the heirs, resulting in a proportional reduction in their respective portions so that they conform to the available estate. It occurs in cases where multiple heirs with fixed shares are present, and the sum of those shares exceeds the origin of the estate (known as aṣl al-mas'ala).
- In the science of inheritance, 'Awl arises from the competition among two or more fixed-share heirs, such that if each heir were to receive their full prescribed share, the total would surpass the estate, leading to the deprivation or reduction of others' rights. Therefore, to uphold equity and preserve all fixed shares, the system proportionally reduces each share. Notably, heirs by ta'sīb (residuary heirs) may be excluded entirely if nothing remains after the fixed shares are distributed-except in specific cases, such as the Mushtaraka issue, which has its own legal treatment. Fixed-share heirs, however, do not lose their entitlement due to the insufficiency of the estate; instead, their shares are adjusted proportionally through 'Awl⁽⁵⁾.
- It is also said: 'ālat al-farā'id (the shares have increased), meaning the shares have become too many to fit the estate. The reduction is then applied collectively, and the estate is distributed according to each heir's proportional share, just as a bankrupt debtor's assets are divided among creditors.

According to scholars such as Ibn 'Abbās, Muḥammad ibn al-Hanafīyya, Muḥammad ibn 'Alī ibn al-Ḥusayn, and 'Aṭā', 'Awl should not apply to inheritance cases, as they held that prescribed shares do not increase. Their position, however, leads to inconsistencies in cases involving a husband, mother, and two maternal siblings. If the mother is reduced to one-sixth due to the presence of two siblings, this would

contradict their view, since they maintained that the mother cannot be reduced unless there are at least three siblings. Consequently, when the number of heirs decreases, they must redistribute the reduction to those whose share was not explicitly lowered by divine decree⁽⁶⁾.

- Legally, the Algerian Family Code defines 'Awl in Article 166, which states:

- "'Awl is the increase in the shares of the fixed-share heirs beyond the origin of the estate. If the total shares exceed the origin, the estate is divided among them in proportion to their respective shares in the inheritance."

This provision constitutes an explicit recognition by the Algerian legislator of the doctrine of 'Awl as a mechanism for resolving cases where the estate is insufficient to satisfy all fixed shares.

In summary, 'Awl refers to the increase in the total number of fractional shares above the origin of the estate, such that the original denominator (e.g., 6, 12, or 24) no longer suffices, and must be raised to match the sum of the shares. It is important to note that 'Awl does not occur in cases where all heirs inherit by ta'sīb (residuary succession); it is exclusive to cases involving fixed-share heirs⁽⁷⁾.

Awl occurs in inheritance cases where the fixed shares of heirs exceed the available estate. In such situations, a proportional reduction is applied to all fixed-share heirs based on their respective entitlements. This system was not explicitly prescribed in the Qur'an or the Sunnah of the Prophet (peace be upon him); rather, it was introduced during the caliphate of 'Umar ibn al-Khaṭṭāb (may Allah be pleased with him). It was opposed by Ibn 'Abbās, who had a different viewpoint. However, each opinion was based on a valid interpretation, and it is well known that such scholarly differences are considered a form of mercy, not a cause for division⁽⁸⁾.

The doctrine of 'Awl did not occur during the time of the Prophet Muhammad (peace be upon him), nor during the caliphate of Abu Bakr (may Allah be pleased with him). It was first applied during the caliphate of 'Umar ibn al-Khaṭṭāb (may Allah be pleased with him), when a case was brought before him involving heirs: a husband and two sisters. The fixed shares conflicted and overlapped, prompting 'Umar to say: "I do not know which of you Allah prioritized so that I may give them precedence, nor which He deferred so that I may delay them." He continued: "If I begin with the husband and grant him his

half, I find nothing left for the two sisters to receive their two-thirds. And if I start with the sisters and give them their share, I find nothing left for the husband." He then said, "Advise me." The first to propose the application of 'Awl was al-'Abbās ibn 'Abd al-Muṭṭalib (may Allah be pleased with him)⁽⁹⁾.

B) subtitle: Determining the Origins of Cases Subject to 'Awl:

The application of 'Awl arises only in specific inheritance cases—namely, those in which the total sum of the prescribed shares for the heirs exceeds the "original denominator" ('aṣl al-mas'alah) of the estate. In such instances, it becomes necessary to adjust this original denominator to correspond with the increased number of shares, in order to fairly distribute the estate without nullifying any legally established share.

Before discussing the specific cases in which 'Awl applies, it is important to clarify the concept of the original denominator ('aṣl al-mas'alah), particularly for those unfamiliar with inheritance calculations. The original denominator refers to the smallest number that can be evenly divided by the denominators of all the prescribed shares, ensuring the distribution of the estate without fractional remainders. It is also known as the base of the inheritance.

For example, if the heirs' shares include one-half and one-third, the original denominator would be 6, as it is the smallest number divisible by both 2 and 3.

There are six prescribed shares (farā'id) in Islamic inheritance law: one-half, one-quarter, one-eighth, two-thirds, one-third, and one-sixth. These shares derive from seven basic denominators (uṣūl al-masā'il)—four of which are not subject to 'Awl, while three are.

The non-'Awl cases are those in which there is only one share or two shares of the same type. For instance:

- One-half alone corresponds to a denominator of 2.
- One-third alone, or combined with two-thirds, corresponds to 3.
- One-quarter alone, or combined with one-half, corresponds to 4.
- One-eighth alone, or with one-half, corresponds to 8.

These cases are not subject to 'Awl because the shares do not exceed the total estate.

By contrast, 'Awl cases involve combinations of different types of shares. For example:

• If one-half is combined with one-sixth, one-third, or two-thirds, the original denominator becomes 6, which may be increased (due to 'Awl) to a maximum of 10.⁽¹⁰⁾

• If one-quarter is combined with any of the above, the original denominator becomes 12, and may undergo 'Awl up to 17 (specifically to 13, 15, or 17).⁽¹¹⁾

• If one-eighth is combined with one-sixth or two-thirds, the denominator is 24, and it may be increased (via 'Awl) to 27-no further⁽¹²⁾.

The case of 24 increasing to 27.⁽¹³⁾

is sometimes referred to as *al-bakhīlah* ("the stingy case") due to its limited scope for 'Awl, and *al-minbariyyah* ("the pulpit case") because 'Alī ibn Abī Ṭālib (may Allah be pleased with him) addressed it publicly from the pulpit, saying: "Its one-eighth became one-ninth. "

Therefore, the denominators 6, 12, and 24 are the most likely to be subject to 'Awl due to the frequent occurrence of overlapping shares among heirs. For instance, if the original denominator is 12 and the total prescribed shares equal 13, the denominator is raised to 13, and the estate is distributed proportionally among the heirs based on their adjusted shares.

Thus, understanding which denominators are subject to 'Awl is essential for grasping the mathematical logic of Islamic inheritance law and for determining when 'Awl is the appropriate legal mechanism to resolve conflicting claims.

The base denominators that are subject to 'Awl are three: 6, 12, and 24.⁽¹⁴⁾

increase in the denominator	The base denominators
7 10 ,9 ,8 ,	6
15 17 ,13 ,	12
27	24

As for the cases that are not subject to 'Awl-meaning there is no increase in the total shares over the base denominator-they are the cases with denominators of 2, 3, 4, and 8.⁽¹⁵⁾

Example of a case with base denominator 2 (non- 'Awl case):

Deceased left behind: a husband and a daughter.

- *Husband: receives one-half ($\frac{1}{2}$), due to the presence of a child (a residuary heir).*

- *Daughter: receives one-half ($\frac{1}{2}$), since she is the only child.*

Base denominator of the estate = 2

- *Husband: $\frac{1}{2} \times 2 = 1$ share*

- *Daughter: $\frac{1}{2} \times 2 = 1$ share*

Total shares = 2, which equals the base denominator. Therefore, this is a just ('ādilah) case, and no 'Awl occurs.

Example of a case with base denominator 8 (non- 'Awl case):

Deceased left behind: a wife, a daughter, and a full sister.

- *Wife: receives one-eighth ($\frac{1}{8}$), due to the presence of a child.*

- *Daughter: receives one-half ($\frac{1}{2}$), as she is the only child.*

- *Full sister: inherits the remainder of the estate as a residuary heir ('aṣabah), in the absence of any closer residuary heir or male counterpart.⁽¹⁶⁾*

Base denominator of the estate = 8

- *Wife: $\frac{1}{8} \times 8 = 1$ share*

- *Daughter: $\frac{1}{2} \times 8 = 4$ shares*

- *Total = 1 + 4 = 5 shares*

- *Remainder = 8 - 5 = 3 shares → go to the full sister as a residuary heir*

Final distribution:

- *Wife: 1 share*

- *Daughter: 4 shares*

- *Full sister: 3 shares*

Total shares = 8, which equals the base denominator. Therefore, this is a just distribution, and no 'Awl applies.

C) subtitle: Conditions for the Application of 'Awl in Inheritance Cases:

- *The presence of multiple heirs entitled to fixed shares (aṣḥāb al-furūd).*

- *The combined value of these fixed shares exceeds the original denominator of the estate (aṣl al-mas'alah).*

- *The absence of a residuary heir ('aṣaba) who would otherwise receive the remainder, as the doctrine of 'Awl is primarily intended to*

safeguard the entitlements of fixed-share heirs.

D) subtitle: Cases Excluded from the Application of 'Awl:

The cases that do not involve 'Awl in the science of inheritance (*Ilm al-Farā'id*) are those in which the shares of the fixed-share heirs do not exceed the origin (base) of the estate. In other words, the total sum of the shares does not surpass the estate's original denominator. These cases are also referred to as "just cases" or "straightforward cases."

- 'Awl does not apply in cases involving only residuary heirs (*aṣāba*).
- It is not applicable when the aggregate of prescribed shares is less than the original denominator; in such situations, the surplus is redistributed through *radd* (return) or assigned to residuary heirs.
- 'Awl is also inapplicable when the total of all fixed shares equals the estate exactly, leaving neither surplus nor shortfall.

E) subtitle: The Importance of Integrating Digital Processing in Calculating 'Awl:

Due to the complexity of the calculations involved in 'Awl cases, judges, notaries, and law students may be prone to errors when settling inheritance matters. This underscores the importance of algorithms, which simplify computational procedures, improve efficiency, and reduce the margin of error.

This study proposes a digital solution through a precise algorithm developed using MATLAB-a program that enables the execution of complex mathematical operations and the translation of juristic rules related to 'Awl into structured computational steps.

The algorithm serves as a practical and reliable tool for judges, notaries, and legal researchers in resolving 'Awl-related inheritance cases, particularly those that involve high levels of numerical complexity.

This section, therefore, lays a solid theoretical foundation for the doctrine of 'Awl from linguistic, juristic, legal, and legislative perspectives, and outlines the principles upon which the algorithm was later developed to implement this doctrine with both precision and practical applicability.

Section II: Applications of ‘Awl and Its Impact on the Heirs’ Shares-Between Traditional Calculation and Digital Processing

Scholars have traditionally relied on a method based on determining the original root of the inheritance problem, then calculating the shares and prescribed portions of the heirs, while taking into account cases of ‘Awl and the resulting increase in the number of shares and the decrease in individual portions.

In solving cases involving ‘Awl, the original root of the estate calculation is elevated to the new total of prescribed shares, after which the heirs’ portions are calculated based on this revised root.⁽¹⁷⁾

With the advancement of digital tools and the widespread adoption of digital transformation across various fields, it has become possible to use mathematical algorithms and software such as Matlab or Python to compute ‘Awl cases with high accuracy and speed. This development facilitates both training and education, and helps reduce the margin of error in practical application.

In this section, we will present practical examples of ‘Awl cases, explaining how to solve them using the traditional method, followed by a model of a digital algorithm that applies the same rules and produces results automatically and systematically, using Matlab.

A) subtitle: Traditional Jurisprudential Steps for Calculating Cases of ‘Awl

1. Identifying the shares due to each heir, in accordance with the provisions of Islamic texts and the Family Law, such as one-half, one-third, one-sixth, etc.

2. Calculating the root of the estate (known as the “Asl al-Mas’alah” or the base denominator): This is determined by finding the least common multiple (LCM) of the denominators of the heirs’ prescribed shares (such as 24, 12, or others).

3. Converting the fractional shares into shares of the estate: Each heir’s fraction is multiplied by the root of the estate to determine the number of shares allocated to them.

4. Summing the shares: The total number of shares due to all heirs is calculated.

5. Comparing the total shares to the root of the estate:

• If the total shares exceed the root of the estate → this results in a case of ‘Awl (proportional reduction).



- If the total equals the root of the estate → there is no case of 'Awl.

6. Adjusting the root of the estate in the event of 'Awl: The new total number of shares becomes the revised root of the estate after 'Awl. Each heir's portion of the inheritance is then recalculated based on this new root.

7. Distributing the estate: The inherited assets are distributed among the heirs in proportion to the revised shares after 'Awl.

Practical examples will subsequently be provided to illustrate the traditional calculation method for cases of 'Awl.

B) subtitle: The Proposed Algorithm for Calculating 'Awl in Inheritance Cases:

I have developed this algorithm to address cases of 'Awl by translating the principles of Islamic inheritance law ('Ilm al-Farā'id) into programmable steps written in the Matlab language. In doing so, I utilized programming resources and artificial intelligence tools to convert religious calculations into precise computational commands.

The algorithm is designed to accept input data such as the number of heirs, their names, and their respective legal shares (expressed as numerators and denominators). It then calculates the root of the inheritance issue by determining the least common multiple (LCM) of the denominators of the heirs' shares. Subsequently, the algorithm computes the number of shares allocated to each heir and sums these shares.

If the total number of shares exceeds the original root of the inheritance issue, the case falls under the category of 'Awl. In such circumstances, the original root is raised to the new total number of shares, and the estate is distributed accordingly, while maintaining the original proportions of the heirs' shares.

The algorithm operates on a general principle applicable to all cases of 'Awl in Islamic inheritance law. It starts by entering the heirs' data and their shares in fractional form, calculates the root of the issue using the LCM of the denominators, computes the shares for each heir, and checks for the occurrence of 'Awl by comparing the total shares to the original root. If 'Awl occurs, the new root of the issue is established, and the estate is distributed based on this updated calculation.

Thus, this algorithm provides a precise and flexible approach for handling various cases of 'Awl, facilitating training and education while minimizing the margin of error in practical applications.

The figure below presents the Matlab code implementing the algorithm I have designed for processing cases of 'Awl in inheritance matters, in accordance with the rules of Islamic jurisprudence and the Algerian Family Code.

```
حساب الموارث العامة مع دعم العول
clear; clc;
fprintf('---برنامج عام لحساب الموارث مع العول\n');
% إدخال عدد الورثة
n = input('أدخل عدد الورثة أصحاب الفروض: ');
% تهيئة مصفوفة الفروض
furood = zeros(n, 2);
asami = strings(n, 1);
% إدخال أسماء الورثة ونسبة كل واحد (بسط ومقام)
for i = 1:n
    asami(i) = input(sprintf('اسم الوارث رقم %d: ', i), 's');
    furood(i,1) = input(sprintf('أدخل البسط لنصيب %s (2/1 في 1 مثلاً): ', asami(i)));
    furood(i,2) = input(sprintf('أدخل المقام لنصيب %s (2/1 في 2 مثلاً): ', asami(i)));
end
% استخراج المقامات
maqamat = furood(:,2);
% حساب أصل المسألة (أقل مضاعف مشترك)
asal-masala = maqamat(1);
for k = 2:length(maqamat)
    asal-masala = lcm(asal-masala, maqamat(k));
end
% حساب عدد الأسهم لكل وارث من أصل المسألة
suhum = (furood(:,1) .* (asal-masala ./ furood(:,2)));
```

```

                                % جمع الأسهم
majmou-suhum = sum(suhum);

                                % التحقق من العول
if majmou-suhum > asal-masala
    fprintf('\n ⚠ (المسألة عائلة) عول تحقق \n');
    asal-masala-jadid = majmou-suhum;
else
    fprintf('\n ✅ (لا يوجد عول) المسألة غير عائلة \n');
    asal-masala-jadid = asal-masala;
end

                                % إعادة حساب الأسهم حسب أصل المسألة الجديد
naseeb = suhum * asal-masala-jadid / majmou-suhum;

                                % عرض النتائج
fprintf('\n--- توزيع الأسهم ---\n');
T = table(asami, suhum, naseeb, ...
    'VariableNames', {'الأسهم-بعد-العول', 'الأسهم-من-الأصل', 'الوارث'});
disp(T);
fprintf('أصل المسألة الأصلي = %d\n', asal-masala);
fprintf('أصل المسألة بعد العول = %d\n', asal-masala-jadid);

```

The legal significance of this algorithm lies in its function as a technical tool supporting professionals in the Algerian judiciary and notarial practice. It enables judges to issue accurate rulings in inheritance cases without falling into calculation errors and assists notaries in drafting estate inventory and partition contracts quickly and precisely. This ensures the protection of heirs' rights and contributes to the stability of legal transactions. Moreover, the algorithm helps reduce judicial disputes arising from manual calculation errors, thereby reinforcing justice and achieving the objectives of the Algerian legislator under the Family Code.

The algorithm developed for calculating 'Awl (proportional reduction) inheritance cases was implemented within the MATLAB programming environment, where it was tested on several real-life scenarios. The results produced by the algorithm were accurate and fully consistent with traditional manual calculations, thereby demonstrating its effectiveness in simplifying the complex computations involved in 'Awl cases.

MATLAB enables the design of a precise algorithm for calculating 'Awl inheritance shares, owing to its powerful capabilities in handling arithmetic operations and matrices. The algorithm operates according to the following steps:

1. Data Entry for Heirs:

The user inputs the number of heirs, their names, and the proportions of their prescribed shares in fractional form (numerator and denominator).

- The program prompts the user to enter the total number of heirs.
- Subsequently, the user enters the details of each heir, including the type of heir (e.g., husband, mother, full sister, etc.) and the amount of their legally prescribed share (expressed as a fraction or percentage).

2. Determination of the Origin of the Estate Problem:

MATLAB employs mathematical functions to calculate the Least Common Multiple (LCM) of all denominators of the prescribed shares, establishing the "origin of the estate problem" (i.e., the total number of shares).

3. Standardization of Denominators for Shares:

- The program converts the entered shares into fractions with common denominators.
- It extracts all denominators of these fractions in order to determine the origin of the estate problem.

4. Calculation of Heirs' Shares:

MATLAB multiplies each heir's fractional share by the origin of the estate problem to compute the exact number of shares allocated to each heir as whole numbers.

5. Calculation of the Total Shares and Verification of 'Awl:

- The program sums the shares calculated for all heirs.
- It compares this total to the origin of the estate problem:

If the total exceeds the origin of the estate problem → a case of 'Awl

(proportional reduction) exists.

If the total is equal to or less than the origin $\rightarrow$ no case of 'Awl exists.

6. Adjustment of the Origin of the Estate in Case of 'Awl:

- If 'Awl is confirmed, MATLAB increases the origin of the estate problem to match the actual total number of shares.

- The program then recalculates the shares of each heir as a proportion of the new origin of the estate problem.

7. Calculation of Each Heir's Entitlement:

- In the case of 'Awl, the entitlement of each heir is computed by dividing the numerator of their (standardized) fractional share by the new origin of the estate problem.

- In the absence of 'Awl, each heir's share is divided by the original origin of the estate problem.

8. Display of Results (Output):

MATLAB displays the final results to the user, including:

- The origin of the estate problem before and after 'Awl
- The number of shares allocated to each heir
- The proportion of the estate each heir receives after 'Awl

9. Ability to Save or Print Results:

MATLAB provides functionality to print the results or export them to files (e.g., Excel or PDF), facilitating their use in legal or notarial work.

The algorithm utilizes the "rat" function available in MATLAB to simplify fractions and present the shares in their simplest possible form, ensuring that the results are clear, easily understandable, and practical for application.

I have verified the algorithm's suitability across various 'Awl inheritance scenarios, and the results obtained were accurate and fully consistent with traditional calculations as established both jurisprudentially and legally, as will be demonstrated below.

C) subtitle: Practical Examples of Calculating 'Awl (Increase of Shares): Between the Traditional Method and Programming Algorithms

In what follows, I will present a set of practical inheritance problems, explaining how to solve them using the traditional method of calculating 'awl. I will also show the results produced by the software algorithm I have developed, with the aim of comparing the two methods and verifying the accuracy of the programmed solution and its consistency with manual calculations.



1- Practical Case (1)-Based on a Common Denominator of 6 –

A woman passed away leaving behind: a husband, a full (german) sister, and a mother.

I will demonstrate how to solve the case using both the traditional method and programming algorithms.

A- Traditional Calculation of the Case Solution:

We first determine the share (fixed portion) of each heir. Then we identify the common denominator of the case, which is calculated by finding the least common multiple (LCM) of the denominators of the heirs' shares.

Unifying the Denominators:

The denominators involved are: 2, 2, and 6.

- The least common multiple (LCM) of 2 and 6 is 6.
- Therefore, the base (common denominator) of the inheritance calculation is set to 6.

increase in the denominator 7	the denominator 6	Share	Heirs
3	3	2/1	husband
3	3	2/1	Full sister
1	1	6/1	mother
3+3+1=7			

- We sum the numerators:

$$3 + 3 + 1 = 7$$

This total exceeds the original base of the estate (6). Therefore, we have a case of 'awl (increase of shares).

In 'awl, the new base of the estate becomes the total of the numerators, i.e. 7.

The share of each heir in the estate after applying 'awl:

- Husband = $3/7$
- Full sister = $3/7$
- Mother = $1/7$

B-Solving the Case Using a MATLAB:

☰
↺
📧
🗑️

--- برنامج عام لحساب الموارث مع العول ---
أدخل عدد الورثة أصحاب الفروض:

3

اسم الوارث رقم 1:

الزوج

أدخل البسط لنصيب الزوج (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الزوج (مثلاً 2 في 1/2):

2

اسم الوارث رقم 2:

الأخت

أدخل البسط لنصيب الأخت (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الأخت (مثلاً 2 في 1/2):

2

اسم الوارث رقم 3:

الأم

أدخل البسط لنصيب الأم (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الأم (مثلاً 2 في 1/2):

6

⚠️ المسألة عائلة (عول تحقق)

--- توزيع الأسهم ---

الأسهم بعد العول	الأسهم من الأصل	الوارث
3	3	"الزوج"
3	3	"الأخت"
1	1	"الأم"

أصل المسألة الأصلي = 6
أصل المسألة بعد العول = 7

>> Saisissez la commande ici

It is noteworthy that the computational output obtained via MATLAB aligns with the manually derived result in accordance with the recognized jurisprudential framework.

2- Practical Case (2) - With an Original Base of 12 -

A deceased person left behind:

- A wife
- A mother⁽¹⁸⁾
- A full (german) sister

A-Solving the Case Using the Traditional Method Distribution According to Fixed Shares:

• Wife: $\frac{1}{4}$ (entitled to one-fourth due to the absence of any inheriting descendant)⁽¹⁹⁾

• Mother: $\frac{1}{3}$

• Full sister: $\frac{1}{2}$

The original base of the estate is 12.

We divide the base by each heir's share.

The sum of the numerators = 13, while the original base is 12, which means that the sum of the fixed shares exceeds the base - a case of 'awl (increase of shares).

Therefore, the base is increased (adjusted) to 13 shares, and the shares become as follows:

<i>increase in the denominator 13</i>	<i>the denominator 12</i>	<i>Share</i>	<i>Heirs</i>
3	$12:4=3$	$1/4$	Wife
4	$12:3=4$	$1/3$	Mother
6	$12:2=6$	$1/2$	Full sister

B-Solving the Case Using a MATLAB Algorithm:

```

--- برنامج عام لحساب الموارث مع العول ---
أدخل عدد الورثة أصحاب الفروض:

3
اسم الوارث رقم 1:
الزوجة
أدخل البسط لنصيب الزوجة (مثلاً 1 في 1/2):
1
أدخل المقام لنصيب الزوجة (مثلاً 2 في 1/2):
4
اسم الوارث رقم 2:
الأم
أدخل البسط لنصيب الأم (مثلاً 1 في 1/2):
1
أدخل المقام لنصيب الأم (مثلاً 2 في 1/2):
3
اسم الوارث رقم 3:
الأخت
أدخل البسط لنصيب الأخت (مثلاً 1 في 1/2):
1
أدخل المقام لنصيب الأخت (مثلاً 2 في 1/2):
2

⚠ المصانة عائلة (عول تحقق)
--- توزيع الأنهم ---
الوارث      الأنهم_من_الأصل      الأنهم_بعد_العول
-----
الزوجة     3                      3
الأم        4                      4
الأخت       6                      6

أصل المصانة الأصلي = 12
أصل المصانة بعد العول = 13

>> Saisissez la commande ici

```

The output of the MATLAB algorithm exhibits full consistency with the results of the conventional manual calculation.

3- Practical Case (4): Based on an Original Estate Base of 24

The deceased left behind: a wife, a mother, a father, and two daughters.

A-Traditional Method of Solving the Case:

<i>increase in the denominator</i> 27	<i>Share out of 24</i>	<i>Share (Fraction)</i>	<i>Heirs</i>
3	$24:8=3$	$\frac{1}{8}$	wife
4	$24:6=4$	$\frac{1}{6}$	mother
4	$24:6=4$	$+\frac{1}{6}$ (‘aṣaba)	father
16 (Each daughter receives 8 shares)	$24 \times 2 \div 3 = 16$	$\frac{2}{3}$	two daughters
Total Shares = 27 → The estate is over-subscribed (‘awl), thus the case is considered ‘ā’ila (adjusted from 24 to 27).			

The total shares = 27 shares → greater than the original estate base (24) → the case involves ‘awl (increase of shares).

- Adjusting for ‘awl:
- The new base of the estate = 27 shares.

B-Calculating the Case Using the MATLAB Program

The calculation performed by the program produced the same result as that obtained using the traditional fiqh-based method.

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الزوجة

أدخل البسط لنصيب الزوجة (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الزوجة (مثلاً 2 في 1/2):

8

اسم الوارث رقم 2:

الأم

أدخل البسط لنصيب الأم (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الأم (مثلاً 2 في 1/2):

6

اسم الوارث رقم 3:

الأب

أدخل البسط لنصيب الأب (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الأب (مثلاً 2 في 1/2):

6

اسم الوارث رقم 4:

البنان

أدخل البسط لنصيب البنان (مثلاً 1 في 1/2):

2

أدخل المقام لنصيب البنان (مثلاً 2 في 1/2):

3

المسألة عائلة (عول تحقق)

--- توزيع الأسهم ---

الأسهم_بعد_العول	الأسهم_من_الأصل	الوارث
3	3	"الزوجة"
4	4	"الأم"
4	4	"الأب"
16	16	"البنان"

أصل المسألة الأصلي = 24
أصل المسألة بعد العول = 27

>> Saisissez la commande ici

The computational results produced by the MATLAB algorithm are in complete agreement with the outcomes obtained via conventional inheritance calculation methods, thereby confirming the algorithm's reliability and precision.

4- Practical Case (4)

The deceased left behind a daughter⁽²⁰⁾, a father, and a mother.

Through this practical example, I will demonstrate a situation in which the base of the estate does not undergo 'awl (increase of shares), in order to test whether the algorithm can correctly identify such a case or not.

A-Traditional Method of Solving the Case:

the denominator6	Share (Fraction)	Heirs
3 سهم = $6 \times (2/1)$	1/2	Daughter
1 سهم = $6 \times (6/1)$	(<i>'aṣaba</i>) + 1/6	Father
1 سهم = $6 \times (6/1)$	1/6	Mother

Unifying the Denominators

The denominators of the shares are: 2, 6, and 6 → the least common multiple (LCM) is 6.

Total shares = $3 + 1 + 1 = 5$ shares

Original estate base = 6 shares

Remainder = $6 - 5 = 1$ share

Distribution of the Remainder (as residuary inheritance)

The father is a residuary heir after fixed shares, so he takes the remainder (1 share).

→ Therefore, the father receives:

- One-sixth as a fixed share = 1 share
- The remainder as a residuary heir = 1 share
- Total share for the father = 2 shares

Final Distribution:

6 Share	Heirs
3	Daughter
2	Father
1	Mother

Is there 'awl (increase of shares) in this case? No, the case does not involve 'awl, nor does it involve radd (redistribution of surplus).

We will test the algorithm developed for analyzing cases of 'awl by applying it to an actual inheritance case, in order to verify its ability to determine whether a case involves 'awl or not. This test represents a practical step to ensure the algorithm's accuracy and its compatibility

with traditional *fiqh*-based calculations.

--- برنامج عام لحساب الموارث مع العول ---
أدخل عدد الورثة أصحاب الفروض:

3

اسم الوارث رقم 1:

البنات

أدخل البسط لنصيب البنات (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب البنات (مثلاً 2 في 1/2):

2

اسم الوارث رقم 2:

الآب

أدخل البسط لنصيب الآب (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الآب (مثلاً 2 في 1/2):

6

اسم الوارث رقم 3:

الأم

أدخل البسط لنصيب الأم (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الأم (مثلاً 2 في 1/2):

6

✓ المسألة غير عائلة (لا يوجد عول)

--- توزيع الأسهم ---

الأسهم بعد العول	الأسهم من الأصل	الوارث
3.6	3	"البنات"
1.2	1	"الآب"
1.2	1	"الأم"

أصل المسألة الأصلي = 6
أصل المسألة بعد العول = 6

>> Saisissez la commande ici

The output generated by the program validates the accuracy of the algorithm, demonstrating full consistency with the results derived through traditional manual calculation.

D) subtitle: Developing a Comprehensive Algorithm for Calculating 'Awl and Radd

After designing the first algorithm, which handled only cases of 'awl (increase of shares), experimental trials revealed that it did not cover non-'awl cases, particularly those requiring the application of the radd system when no residuary heirs exist.

From this standpoint, a comprehensive algorithm was developed to account for both scenarios. It begins by analyzing the case through calculating the fixed shares and the estate's base (asl al-mas'alah). Then it determines whether the case involves 'awl, in which case it applies the necessary adjustments, or whether it is a non-'awl case with no residuary heirs. In the latter situation, it redistributes the remainder among the heirs entitled to fixed shares, in accordance with the rules of radd derived from Islamic jurisprudence, especially the Maliki school adopted in the Algerian Family Code.

I have developed and improved the algorithm for calculating inheritance shares so that it is now capable of handling all cases of 'awl (increase of shares) and radd (redistribution of surplus) with precision. I have added a mechanism for unifying denominators to determine the base of the estate, followed by comparing the total shares to the estate base to identify whether the case requires 'awl or radd. The algorithm then redistributes the shares correctly according to Islamic legal rules.

MATLAB Drive > radmatlab.m

```

1 % -----
2 % برنامج لحساب الغول والزبد وتحديد أصل المسألة وتوزيع السهام
3 % -----
4 clear; clc;
5
6 fprintf('--- برنامج لحساب الغول والزبد في الميراث ---\n');
7
8 % إدخال عدد الورثة
9 n = input('أدخل عدد الورثة أصحاب الغرور: ');
10
11 % تهيئة المتغيرات
12 asami = strings(n, 1); % أسماء الورثة
13 bust = zeros(n, 1); % البسط
14 maqam = zeros(n, 1); % المقام
15
16 % إدخال البيانات
17 for i = 1:n
18     asami(i) = input(sprintf('\n اسم الوارث رقم %d: ', i), 's');
19     bust(i) = input(sprintf('أدخل البسط للنصيب %s (1/2 في 1 مثلا): ', asami(i)));
20     maqam(i) = input(sprintf('أدخل المقام للنصيب %s (1/2 في 2 مثلا): ',
21     asami(i)));
22 end
23
24 % حساب أصل المسألة (LCM لتلقيمات)
25 asal_masala = maqam(1);
26 for i = 2:n
27     asal_masala = lcm(asal_masala, maqam(i));
28 end
29
30 % حساب السهام من أصل المسألة
31 suhum = bust .* (asal_masala ./ maqam);
32 majmou_suhum = sum(suhum);
33
34 % الحالة
35 if majmou_suhum > asal_masala
36     fprintf('\n ⚠ توجد حالة **\n');
37     asal_masala_jadid = majmou_suhum;
38
39 elseif majmou_suhum < asal_masala
40     fprintf('\n ⚠ توجد حالة ** زبد\n');
41     asal_masala_jadid = majmou_suhum; % الرذ: أصل المسألة الجديد = مجموع ✓
42
43 else
44     fprintf('\n ✓ لا توجد حالة غول ولا زبد\n');
45     asal_masala_jadid = asal_masala;
46 end
47
48 % إعادة توزيع الأسهم بعد تعديل أصل المسألة
49 naseeb = suhum ./ asal_masala_jadid .* majmou_suhum;
50
51 % عرض النتائج
52 T = table(asami, bust, maqam, suhum, naseeb, ...
53     'VariableNames', {'الوارث', 'البسط', 'المقام', 'الأسهم_قبل', 'الأسهم_بعد'});
54 disp(T);
55
56 fprintf('🔴 أصل المسألة = %d\n', asal_masala);
57 fprintf('🔴 0.% = مجموع الأسهم\n', majmou_suhum);
58 fprintf('🔴 0.% = أصل المسألة النهائي\n', asal_masala_jadid);

```

As a result, the algorithm has become capable of solving various inheritance cases, whether they involve neither 'awl nor radd, or whether they pertain to either of them.

Below is a practical example illustrating how to use the algorithm in a situation where there is no 'awl, but rather the opposite case found in inheritance matters.

1-Example: He died leaving behind daughter and a mother.

A-Traditional Steps for Solving the Case:

Determining the fixed shares:

- The daughter: entitled to one-half ($\frac{1}{2}$) because she is alone.
- The mother: entitled to one-sixth ($\frac{1}{6}$) due to the presence of an inheriting descendant (the daughter).

أصل المسألة 6	Share	Heirs
3	2/1	daughter
1	6/1	mother
4=1+3		

The base of the estate:

We subtract the sum of the shares: $6-4 = 2$

Thus, the remaining portion is subject to radd (redistribution) among the fixed-share heirs in proportion to their shares - except for the husband or wife (who are not present in this case).

Remaining estate:

- Are there any residuary heirs ('asaba)?

No - there is no father, no brother, no son, and no one who could substitute for them.

- Therefore, the remainder is redistributed (radd) among the fixed-share heirs according to the proportion of their original shares (excluding husband or wife - and neither is present here).

Final solution: Redistribution (radd).

The estate is reverted to 4	the denominator 6	Share	Heirs
3	3	2/1	daughter
1	1	6/1	mother



Final Result:

- The daughter: $\frac{3}{4}$
- The mother: $\frac{1}{4}$

B-Calculating the Case Using the MATLAB Program

The calculation performed by the program produced the same result as that obtained using the traditional fiqh-based method.

--- برنامج لحساب العول والرد في الميراث ---
أدخل عدد الورثة أصحاب الفروض:

2

اسم الوارث رقم 1:

البنات

أدخل البسط لنصيب البنات (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب البنات (مثلاً 2 في 1/2):

2

اسم الوارث رقم 2:

الأم

أدخل البسط لنصيب الأم (مثلاً 1 في 1/2):

1

أدخل المقام لنصيب الأم (مثلاً 2 في 1/2):

6

⚠️ توجد حالة **رد** ⚠️

--- توزيع السهام ---

الوارث	البسط	المقام	الأسم_قبل	الأسم_بعد
البنات	1	2	3	3
الأم	1	6	1	1

أصل المسألة = 6
مجموع الأسهم = 4
أصل المسألة النهائي = 4

>> Saisissez la commande ici

This algorithm demonstrates great flexibility and efficiency in handling various cases, and its results have proven accurate when compared to traditional Islamic jurisprudential calculations. This makes it a practical and reliable tool that can be used by judges, notaries, and professionals involved in estate settlements, especially in complex or computationally challenging cases.

Conclusion:

The study confirms that the doctrine of 'Awl, as codified in Algerian Family Law, is firmly rooted in Islamic jurisprudence, particularly the Mālikī school. It functions as a legal mechanism to resolve inheritance cases in which the fixed shares of heirs exceed the total estate, ensuring proportional reduction while preserving justice and legal balance.

Given the complexity of 'Awl calculations, the integration of algorithmic tools, such as the MATLAB-based model developed in this study, marks a valuable step forward in bridging traditional inheritance theory with modern computational methods. Notably, the computational results produced by the algorithm fully correspond to those derived through classical jurisprudential calculations, thereby validating both the accuracy and the legal reliability of this approach.

This work illustrates the feasibility of applying intelligent legal technologies to personal status matters and opens promising perspectives for future enhancements, including the automation of other inheritance scenarios like radd, ta'ṣīb, and ḥijb. Ultimately, such digital tools can support judges, notaries, and legal professionals in improving both the efficiency and integrity of estate distribution processes.

- Recommendations:

1. Ensure Data Accuracy: Users of the algorithm (judges, notaries, or lawyers) must meticulously verify the correctness of the input data, such as the prescribed shares and heirs' proportions, as any error in the inputs leads to incorrect results in 'awl cases.

2. Consider the Algorithm as an Aid, Not a Substitute: The algorithm should be viewed as a tool to facilitate mathematical calculations without replacing the necessary legal or jurisprudential oversight to verify the validity of the results.

3. Adapt the Algorithm to the Maliki School: It is recommended to adjust the algorithm to align with the provisions of the Maliki school, which is followed in Algeria, especially concerning the calculation of the estate origin (asl al-mas'ala) and 'awl, to avoid discrepancies in results.

4. Develop User-Friendly Arabic Interfaces: To make it easier for notaries, lawyers, and judges to use the algorithm in 'awl cases, it is advisable to develop software interfaces in Arabic that display



calculation steps and results clearly and simply.

5. *Incorporate Scholarly Documentation into the Software:* Any software used for estate settlement should include documentation explaining the jurisprudential and legal basis for the 'awl calculations, ensuring transparency and reliability.

6. *Engage Experts with Dual Specializations:* It is recommended to involve specialists in both Islamic jurisprudence and law, alongside programmers, in developing or reviewing the algorithm to ensure results are accurate and consistent with legal and religious texts.

7. *Provide Continuous Training:* Judges, notaries, and lawyers should receive ongoing training on how to use such algorithms, enabling them to benefit from these tools without errors or misunderstandings of their results.

Referrals and References:

⁽¹⁾-MATLAB is a scientific and technical software specialized in mathematical computations and numerical analysis. It is used to perform complex calculations and data processing and is distinguished by its ability to develop algorithms and mathematical models. It serves as an effective tool in supporting legal studies that require high computational accuracy, such as inheritance cases.

⁽²⁾- Articles 126 to 183 of the Algerian Family Code.

⁽³⁾- Muhammad ibn Ya'qub al-Fayruzabadi, *Al-Qamus al-Muhit*, 8th ed. (Beirut: Al-Resalah Publishing and Distribution, 2005), 3.

⁽⁴⁾-Ahmed Dakkar, *Solved Problems in Inheritance and Estates*, 1st ed. (Algiers: Dar Al-Jaiza, 2013), 16.

⁽⁵⁾- Zafar Ahmad al-Uthmani al-Thanawi, *I'la al-Sunan*, 3rd ed., vol. 18 (n.p.: Idarat al-Qur'an wa al-'Ulum al-Islamiyya, 1993), 402.

⁽⁶⁾- Ibn Muflih, Burhan al-Din Abu Ishaq ibn Muhammad ibn 'Abd Allah al-Hanbali, *Al-Mubdi' fi Sharh al-Muqni'*, 154.

⁽⁷⁾- Ibid, 274.

⁽⁸⁾- Noha Ahmed Abdel-Hamid Eid, *Al-'Awl as a Means of Ending Jurisprudential and Legal Disputes in Light of Azhar Documents: A Comparative Jurisprudential Study, The First International Scientific Conference of the Faculty of Islamic and Arabic Studies for Women, Al-Azhar University (2021)*, 19.

⁽⁹⁾- Ahmad ibn Yahya ibn al-Murtada, *Al-Bahr al-Zakhkhar al-Jami' li-Madhahib 'Ulama' al-Amsar*, 2nd ed., vol. 1 (Beirut: Al-Resalah Foundation, 1975), 43.

⁽¹⁰⁾- Shams al-Din Muhammad ibn Abi al-'Abbas Ahmad ibn Hamzah ibn Shihab al-Din al-Ramli, *Nihayat al-Muhtaj ila Sharh al-Minhaj*, vol. 6 (Beirut: Dar al-Fikr, 1404 AH), 10.

⁽¹¹⁾- Muwaffaq al-Din 'Abd Allah ibn Ahmad ibn Qudamah al-Maqdisi, *Al-Mughni fi Fiqh al-Imam Ahmad ibn Hanbal al-Shaybani*, vol. 6 (Riyadh: Maktabat al-Riyadh, 1412 AH), 1.



⁽¹²⁾- Shams al-Din al-Dusuqi, *Hashiyat al-Dusuqi 'ala al-Sharh al-Kabir* (n.p.: Dar Ihya' al-Kutub al-'Arabiyya, n.d.), 47.

⁽¹³⁾- Abu al-Hasan 'Ali ibn Sulayman al-Mardawi, *Al-Insaf fi Ma'rifat al-Rajih min al-Khilaf 'ala Madhhab al-Imam Ahmad ibn Hanbal*, vol. 7.

⁽¹⁴⁾- Ali Fakhr, *The Simplest Explanation of the Concept of 'Awl in the Science of Inheritance*, YouTube video, <https://youtu.be/fY8jUn-5iGI> (accessed 22 July 2025).

⁽¹⁵⁾- Ahmad Dakkar, *op. cit.*, 17.

⁽¹⁶⁾- The full sister becomes a residuary heir ('Asaba) with female descendants (daughters or granddaughters), based on the saying of the Prophet (peace be upon him): 'Make the sisters residuaries with the daughters.' Thus, she inherits the remainder as a residuary heir after the Qur'anic heirs, provided that there is no male relative to render her a residuary or to exclude her.

⁽¹⁷⁾- Muhammad ibn 'Abd al-Rahim, *Al-Mirath al-Muqaran (Comparative Inheritance)*, n.ed. (Beirut: Dar al-Tanwir for Printing and Publishing, 1997), 39.

⁽¹⁸⁾- According to the provisions of Article 148 of the Algerian Family Code, the mother inherits one-third of the estate in the absence of a descendant heir or when there are multiple siblings-whether full, paternal, or maternal-even if they are not entitled to inherit.

⁽¹⁹⁾- See also Article 145 of the Algerian Family Code.

⁽²⁰⁾- The daughter (as a sole female heir): She is entitled to one-half (1/2) of the estate as a prescribed share, provided that she is the only daughter and no residuary male heir (son) exists.

The mother: She is entitled to one-sixth (1/6) of the estate, by reason of the existence of a descendant heir (the daughter).

The father: He is entitled to one-sixth (1/6) as a fixed share due to the presence of a descendant heir, in addition to the remainder of the estate by way of residuary succession ('asaba) after the distribution of the prescribed shares.