Nuh Aydin • Lakhdar Hammoudi

Al-Kāshī's Miftāḥ al-Ḥisab, Volume I: Arithmetic

Translation and Commentary

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Preface

It is unfortunate that one of the most important mathematics books of the medieval Islamic civilization,[1] namely *Miftāḥ al-Ḥisab* written by *al-Kāshī* in 1427, has not been fully translated to English before. In fact, until the middle of the twentieth century it was unknown to modern researchers [22]. According to Rashed [26], traditional history of mathematics was shaken by Luckey's discovery of this monumental work. *Miftāḥ Al-Ḥisab* is written in Arabic and has never been fully translated to another language except for Russian [29]. Also, two small sections of *Miftāḥ* are translated to English, one on root extraction [13], and another one on measuring the areas of muqarnas [15]. Before *Miftāḥ* was discovered by modern researchers, the discovery of decimal fractions was incorrectly attributed to Simon Stevin [24]. *Miftāḥ* contains a systematic treatment of decimal fractions, yet al-Kāshī is not the inventor of decimal fractions. According to best available sources, decimal fractions were first introduced in the middle of the tenth century by Abū al-Ḥasan Aḥmad ibn Ibrāhīm al-Uqlīdisī [31].[2] The story of *Miftāḥ* and the discovery of the contributions of al-Kāshī to mathematics and astronomy by modern researchers is a reflection of a larger story in the history of science that is called "the classical narrative" by Saliba [32]. One of the tenets of this narrative is the assumption that the scientific progress and production in the Islamic world stopped well before the fifteenth century. By presenting this book, we hope to contribute to the growing body of evidence that quells this narrative. For a long time, a Eurocentric version of the history of science has been in the making with a huge deficit in research on primary sources of scientific works in the Islamic civilization as well as other civilizations such as Chinese and Indian. Since the second half of the twentieth century much research has been conducted to remedy this situation and a lot of progress has been made. However, more work is needed on two fronts. (1) There is still a wealth of primary sources waiting to be studied in many parts of the world, and (2) more efforts are needed to disseminate accurate information about Islamic science to counter and repair the damaging effects of the classical narrative. To illustrate, the personal stories of the authors of this book are really instructive. The first author who was born and raised in the capital of the Ottoman Empire[3] was unaware of the profound contributions of Islamic scholars to mathematics and science until a few years ago. It was disappointing for him to learn that the unique copy of al-Uqlīdisī's *Kitāb al-fuṣūl fī al-Ḥisāb al-Hindī* was in Yeni Cami Library in his hometown, yet nobody studied it until the 1960s [30]. When it was finally translated to English and made widely available [31], incorrect attributions about the origin of

[1] We will be using the terms "Islamic civilization" and "medieval Islamic civilization" in a very broad sense. We are particularly referring to the medieval Islamic civilization for which the time period extends approximately from late seventh century to the sixteenth century (inclusive). Geographically, it spans a large region—from Spain to the west to China, and India to the east. Therefore, it encompasses much diversity in terms of languages, ethnicity, and cultures. It also contains many different political powers and organizations (such as Umayyads, Abbasids, Fatimids, al-Andalus, Seljuks, Ottomans, Safavids, and others). It was ethnically and religiously highly diverse in which individuals from many different backgrounds contributed to scientific knowledge and progress, being a Muslim was not a prerequisite for this contribution. Arabic was the language of science during this time period, and it has been the language of religious studies. Once again, we use the term in a very broad sense and in no way do we imply a monolithic culture or civilization.

[2] It is astonishing that false information about the invention of the decimal fractions is still repeated in books published in the twenty-first century (e.g., [14]) and when the authors discuss the history of decimal fractions they leave out the most relevant figures such as al-Uqlīdisī and al-Kāshī.

[3] That is Istanbul in modern day Turkey.

decimal fractions had been, and are still, circulating. The second author was born and raised not far from where the famous mathematician Leonardo of Pisa, otherwise known as Fibonacci, spent time studying mathematics in Algeria. The contributions of Fibonacci are well documented, yet nothing transpires about his teachers in Algeria. Therefore, studying primary sources, making them available to a larger audience, and disseminating research findings to the general public are very important activities. The first author found manuscript copies of *Miftāḥ* in Süleymaniye library in Istanbul and realized that they seem to be largely unknown in the literature. We use some of these manuscripts in this translation. It is our belief that the full translation of *Miftāḥ* will contribute to the writing of a universal history of mathematics that is inclusive. We are confident that a careful reading of *Miftāḥ Al-Ḥisab* will provide us with a broader, more accurate overview of the state of knowledge of mathematics in the eastern part of the Muslim world in the fifteenth century. Further research that can be generated from this book will undoubtedly lead to a better understanding of mathematical concepts and techniques used at the time. We hope that publishing *Miftāḥ Al-Ḥisab* in three volumes, Arithmetic, Geometry, and Algebra, will serve this purpose well.

The authors would like to thank the anonymous reviewers and staff of Birkhäuser for their hard work and professionalism. Special thanks go to Chris Tominich for his help and constructive feedback.

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The first author is grateful to his parents Fatima and Ahmed Aydin for all of their sacrifices. He is also grateful to his wife Asiye and children Betül, Beyza, and İsmail for their support and understanding. His special thanks go to Professor Joan Slonczewski of Kenyon College who first came up with an idea that led to his journey into the history of Islamic mathematics that culminated in this publication. He is similarly thankful to Dr. Jennifer Nichols and Dr. Nahla Al-Huraibi who helped him with learning Arabic.

The second author is particularly grateful to his wife Soumya Bouchachi and his kids Esam, Ibrahim, and Yasmine for being supportive and understanding of his absences and shortcomings. A special dedication to his late parents Benghadfa Hammoudi (1929–2012) and Aicha Messai (1936–2017): may God bless them for their lifelong support of education and pursuit of knowledge.

Both authors greatly appreciate and acknowledge the work of Ghada Bakbouk for her meticulous editing of the translation of this volume and correcting many errors. Any remaining errors are due to the authors.

We dedicate this volume to the memory of Professor Fuat Sezgin, a prominent researcher in the history of mathematics and science in the Islamic civilization who recently passed away. He was a remarkable and leading scholar in the field who was a source of great inspiration for us. His exceptional dedication and monumental work will continue to be important for future researchers. We humbly hope that this volume will contribute to the purpose to which he dedicated his long and productive life.

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