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THE CONCEPT OF LEARNING CELESTIAL SCIENCE IN THE BOOK "WASILAH AL-MUBTADI'IN FI RISALAH AL-QAMARAIN"

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Abstract: This study explores the concepts of celestial science education within the work of Muhammad Yunus bin Abdullah, a lesser-known Falak scholar in Indonesia, particularly in East Java, and his book "Risālatil Qamaraīn Fī Ijtimā'in Nayyiraīn." Classified as Taqribi Hisab Hakiki, the book undergoes an extensive content analysis, involving a literature review and qualitative interviews with celestial science experts. The findings indicate that the book "Wasīlah Al Mubtadi'īn Fī Tarjamati Risālatil Kamaraīn Fī Ijtimā'in Nayyiraīn" presents a comprehensive approach to learning celestial science, covering fundamental concepts, intricate calculations of the lunar month initiation, and detailed explanations of astronomical phenomena. Utilizing classical Arabic terms explained in Javanese Arabic (pego), the book maintains a connection with traditional celestial science while ensuring local accessibility. Emphasizing the disparities between sidereal and synodic months, the text integrates practical applications of arithmetic and trigonometric principles. Notably, acknowledging multiple sources indicates a broad approach to celestial science education, and the inclusion of practical information fosters a balance between theoretical and applied knowledge, aligning the study with both classical and modern perspectives in celestial science.

Keywords: learning; celestial science; classic book

Abstrak: Studi ini menggali konsep-konsep pembelajaran ilmu falak dalam karya Muhammad Yunus bin Abdullah, seorang ahli falak yang kurang dikenal di Indonesia, khususnya di Jawa Timur, dan bukunya "Risālatil Qamaraīn Fī Ijtimā'in Nayyiraīn." Diklasifikasikan sebagai Taqribi Hisab Hakiki, buku ini dianalisis kontennya secara ekstensif, melibatkan tinjauan literatur dan wawancara kualitatif dengan ahli ilmu falak. Temuan penelitian menunjukkan bahwa buku "Wasīlah Al Mubtadi'īn Fī Tarjamati Risālatil Kamaraīn Fī Ijtimā'in Nayyiraīn" menyajikan pendekatan komprehensif dalam pembelajaran ilmu falak, mencakup konsep dasar, perhitungan rumit awal bulan Qamariyah, dan penjelasan rinci tentang fenomena astronomi. Dengan menggunakan istilah bahasa Arab klasik yang dijelaskan dalam bahasa Arab Jawa (pego), buku ini tetap terhubung dengan tradisi ilmu falak sambil memastikan aksesibilitas lokal. Dengan menekankan perbedaan antara bulan sideris dan sinodik, teks ini mengintegrasikan aplikasi praktis prinsip aritmatika dan trigonometri. Pentingnya mengakui sumber-sumber ganda menunjukkan pendekatan yang luas terhadap pendidikan ilmu falak, dan penyertaan informasi praktis membangun keseimbangan antara pengetahuan teoritis dan terapan, sejalan dengan pandangan klasik dan modern dalam kajian ilmu falak.

Kata kunci: Pembelajaran; ilmu falak, kitab klasik

Introduction

Astronomy, the study of celestial bodies and the universe, finds its focused counterpart in Falak, a branch of astronomy that specifically delves into the examination of two celestial bodies other than Earth – the Moon and the Sun.(Rakhmadi Butar-Butar, 2019) The significance of these two celestial bodies in Muslim rituals, determining prayer times, fasting commencement and conclusion, zakat obligations, and the pilgrimage to the Holy Land, highlights the pivotal role of Falak(Habibullah Ritongga, 2020). Astronomy, among the oldest sciences, has roots in ancient Greek observations of celestial bodies, a tradition that flourished during the golden age of Islamic astronomy, particularly in the field of Falak. In the 8th century, during the caliphate of Ma'mun, figures like Al-Khawarizmi, renowned for the discovery of zero, and subsequent Islamic astronomers such as Abu Ma'syar al-Falaky, Ibn Jabir al-Battany, and Abu Raihan al-Biruni, made significant contributions(Ahmad Luthfi, 2022).

Over the centuries, the dissemination of Falak knowledge has been extensive, evident in its historical journey from the Middle East to the Indonesian archipelago(Ma'u, 2019). Numerous authentic examples, including the deep knowledge possessed by Falak scholars, highlight the widespread influence of Falak in the Nusantara region. Many Falak scholars in Indonesia have left monumental works, including detected and yet-to-be-detected manuscripts. Among these works are "Tadzkiratul Ikhwan fi ba'dl at-tawarikh wa al 'Amal al-Falakiyyah" by Ahmad Dahlan at-Tarmasi(Maghfuri, 2022), "Sullam an-Nayyirain fi Ma'rifah al-Ijtima' wa al-Kusufain" by Muhammad Manshur bin Abdul Hamid Dumairi al-Batawi, "Fath Rauf al-Mannan fi 'Amal al-Kusuf bi Zaij ad-Dahlan as-Samarany" by Abu Hamdan Abdul Jalil bin Abdul Hamid al-Qudusy, "Almanak Djamiliyah" by Djamil Djambek, "Dliya' al-Nayyirain fi ma Yata'llaq bi al-Kawakib" by Djamil Djambek, "al-Kutub al-Falakiyyah" by Abdul Faqih, "Matahari dan Bulan dengan hisab" by Ahmad Kasir al-Malangi, "Muntaha Nataij al-Aqwal dan Jadwalul Auqat" by Syeikh Muhammad Hasan Asy'ari Pasuruan, "ad-Durus al-Falakiyyah lil Madaris as-Salafiyyah dan Badi'atul Mitsal fi Hisabat as-Sinin wa al-Hilal" by Muhammad Ma'shum bin Ali Jombang(Muammar et al., 2020), "al-Khulashoh al-Wafiyyah fil Falak bi Jadwal al-Lugharitmiyyah" by Zubair Umar al-Jilani, and "Nurul Anwar min Muntaha al-Aqwal" by Nur Ahmad bin Shadiq Suryani Jepara(Rakhmadi Butar-Butar, 2019).

Among the lesser-known Falak scholars in Indonesia, particularly in East Java, is Muhammad Yunus bin Abdullah. His work titled "Risālatil Qamaraīn Fī Ijtimā'in Nayyiraīn" is intentionally highlighted for discussion and codification, incorporating existing astronomical knowledge. The primary focus is on extracting the concepts of learning Falak contained in the book, although it is categorized as a Taqribi Hisab Hakiki.

Method

The research methodology applied to delve into the concept of celestial science in Muhammad Yunus bin Abdullah's book, "Risālatil Qamaraīn Fī Ijtimā'in Nayyiraīn," is primarily centered around an extensive content analysis.(Griffin & Griffin, 2021) Initially, a thorough literature review is conducted to gain insights into the historical background of celestial science within the Islamic context, with a specific focus on its development in Indonesia and East Java. Subsequent to this, a meticulous examination of the book's content is undertaken, emphasizing the identification of classical terminologies, comprehension of time calculation methods, and extraction of theoretical concepts embedded in the teachings of celestial science.

Furthermore, the research methodology involves qualitative interviews with celestial science experts or scholars well-versed in the nuances of the book(Roberts, 2020). These interviews aim to provide a nuanced understanding of the celestial science concepts presented in "Risālatil Qamaraīn Fī Ijtimā'in Nayyiraīn." This multifaceted approach ensures a comprehensive exploration of the instructional elements related to celestial science within the specific context of the mentioned book, shedding light on its unique contributions and significance in the realm of celestial knowledge.

Results and Discussion

A Glimpse Into The Author

Muhammad Yunus bin Abdulloh, hailing from Kediri, emerges as the esteemed author behind the scholarly work "Risālatil Qamaraīn Fī Ijtimā'in Nayyiraīn," which saw its creation in the year 1353 H, corresponding to the conclusion of 1934 CE. In a meticulous exploration of the author's biography, these details provide a glimpse into the life and times of a scholar deeply immersed in celestial science during the early 20th century.

Delving into the temporal and geographical backdrop of the book's inception unveils a noteworthy alignment with the lifespan of Sheikh Ma'shum bin Ali al-Maskumambangi.(Maesyaroh, 2017) This notable scholar, renowned for his work "ad-Durus al-Falakiyyah dan Badi'atul Mitsal," was contemporaneous with Muhammad Yunus and was associated with the Tebuireng Islamic Boarding School in Jombang. This synchronicity in their timelines adds an intriguing layer to the narrative, suggesting a shared era of scholarly pursuit and celestial exploration.(Wahyudin, 2019)

Systematics Within The Book

The book, titled "Wasīlah Al Mubtadi'īn Fī Tarjamati Risālatil Kamaraīn Fī Ijtimā'in Nayyiraīn," authored by Muhammad Yunus bin Abdulloh from Kediri, is a relatively thin volume encompassing approximately 40 pages. Originally written in Arabic, it was later translated into Javanese Arabic (pego), reflecting the author's commitment to ensuring accessibility to a broader audience. The content of the book is intricately organized into two main sections: the Initial Calculation of the Lunar Month and the Calculation of Lunar Eclipse Phenomena.

Within the chapter dedicated to the initial calculation of the lunar month, readers are guided through several sub-chapters, each addressing key aspects of celestial science. These include the straightforward definition of Ijtima' (Conjunction), the classification of buruj (constellations/zodiac signs), a concise explanation of Muhaq occurrence, a detailed exploration of the synodic and sideral moon's journey, an examination of various moon phases, and a thorough procedure for calculating the time of ijtima' involving both the moon and the sun. The inclusion of astronomical data related to the moon and the sun further enriches the narrative, highlighting the integration of theoretical knowledge and practical applications in celestial science.

Additionally, this chapter delves into explanations regarding fundamental concepts such as "Days (Ayyām/م), Hours (Sā'ah/عة), Minutes (Daqīqoh/قة)," as well as insights into "Zodiac signs (Burūj/ج), Degrees (Darojah/جة), Minutes (Daqīqoh/قة)." The author provides clarity on the principles of Ijbār (number rounding) and Ilgho' (neglect), demonstrating the meticulousness required in celestial calculations. The methodology extends to include interpolation of correction data (Ta'dīl Bain Saṭrain), determination of longitude difference (fadl thulain), multiplication in base-60 (Ḍorbus Sittīn), multiplication balance, precise methods for locating the position of the crescent moon (Haiatu Hilāl), and considerations of its direction, altitude, duration above the horizon, brightness, and position in specific buruj (Manzilatul Hilāl).

The second chapter is dedicated to the detailed explanation of calculating the estimated occurrence of lunar eclipse phenomena. Here, the author meticulously outlines the entire process of calculating lunar eclipse events, providing readers with a comprehensive understanding of these celestial occurrences. It is evident that Muhammad Yunus's work, though not widely recognized among contemporary scholars, represents a significant contribution to the realm of celestial science, particularly within the context of Javanese Arabic scholarship in Indonesia.

To further enhance the comprehension of the book's content, a summarized table is presented below:

Table 1. Table: Summary of Sub-Chapters in "Wasīlah Al Mubtadi'īn Fī Tarjamati Risālatil Kamaraīn Fī Ijtimā'in Nayyiraīn"

Sub-Chapter	Focus
Simple Definition of Ijtima' (Conjunction)	Understanding the basic concept of lunar conjunction
Classification of Buruj (Zodiac Signs)	Categorization of constellations and zodiac signs

Sub-Chapter	Focus
Brief Explanation of Muhaq Occurrence	Concise insight into the occurrence of Muhaq
Journey of Synodic and Sideral Moon	Exploration of the travel patterns of the two lunar phases
Various Moon Phases	Examination of different phases the moon goes through
Procedure for Calculating Ijtima' Time	Step-by-step calculation of the conjunction time
Explanation of Astronomical Data	Elaboration on astronomical data related to moon and sun
Basis of Days, Hours, Minutes	Understanding the foundational units of time
Zodiac Signs, Degrees, Minutes	Clarification on the celestial coordinates
Explanation of Ijbār and Ilgho'	Insights into number rounding and neglect principles
Interpolation of Correction Data (Ta'dīl Bain Saṭrain)	Methodology for correcting interpolated data
Longitude Difference Calculation (Fadl Thulain)	Determining the difference in longitude between two points
Multiplication in Base-60 (Ḍorbus Sittīn)	Application of multiplication principles in base-60
Multiplication Balance	Balancing the multiplication process
Locating Crescent Moon Position (Haiatu Hilāl)	Precise techniques for determining the crescent moon's position
Crescent Moon Direction	Considerations of the direction in which the crescent moon appears
Crescent Moon Altitude	Determination of the crescent moon's angular height
Duration Above the Horizon (Mukuts Hilāl)	Estimating the duration for which the crescent moon remains above the horizon
Brightness of Crescent Moon (Qousu Nuril Hilāl)	Calculation of the brightness of the crescent moon
Crescent Moon Position in Specific Buruj (Manzilatul Hilāl)	Identifying the crescent moon's position in specific constellations

In essence, Muhammad Yunus's work emerges as a valuable resource, contributing to the celestial knowledge tradition in Indonesia and shedding light on the nuanced methods of calculating lunar phenomena. Despite its relatively modest recognition, the book encapsulates a wealth of insights into the intersection of theoretical and applied celestial science within the context of Javanese Arabic scholarship.

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Analysis Of Theory And Data Used in The Book "Risālatul Qamaraīn"

In the initial discussion of the book "Risālatul Qamaraīn Fī Ijtimā'in Nayyiraīn," the concept of Ijtima' is elucidated, defined as "الإجتماع النيرين عبارة عن كونها في موضع واحد من فلك البروج," meaning the conjunction when the sun and moon are in the same position in the zodiac. This aligns with the astronomical term conjunction, which refers to the event when the sun and moon are located on the same longitude line, observable from both the east and west. Muhyiddin Khazin further interprets Ijtima' as the "position of the sun and moon being at the same astronomical longitude."

The book also covers the twelve constellations (buruj) in celestial science, starting from Haml, Tsur, Jauza', Sarathan, Asad, Sunbulah, Mizan, Qous, Jadyu, Dalwu, and Huut. These constellations are divided into two groups: those in the northern hemisphere and those in the southern hemisphere of the celestial sphere. This corresponds to the twelve zodiac signs in general astronomy along the ecliptic path traversed by the sun: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces.

The term Muhaq, as explained in "Risalatul Qamarain," refers to the loss of moonlight due to the moon being positioned between the sun and the earth, leading to lunar eclipse phenomena, which occur only at the end of the lunar month. This mirrors contemporary celestial science, where the appearance of the moon varies daily due to its orbit around the earth. The book introduces phases of the moon, starting with the crescent (Hilal), progressing to the first quarter (Tarbi' Awal), full moon (Badr), last quarter (Tarbi' Tsani), and finally, the hidden phase (Muhaq).

The author presents the duration of the lunar month in both sidereal and synodic terms, indicating that the time for the moon to return to the same position is 27 days, 7 hours, 43 minutes, and 4.30 seconds, while the time for the second conjunction is 29 days, 12 hours, 44 minutes, and 2.26 seconds. The book distinguishes between sidereal and synodic months, with the former representing the moon's complete orbit (27 days, 7 hours, 43 minutes, 11/30 seconds) and the latter being the time between two conjunctions (29.5 days/29 days, 12 hours, 44 minutes, 2.8 seconds).

The practical calculations of Ijtima' time using the "Risalatul Qamarain" system require accurate data collection of al-'allamah, al-khossoh, al-hissoh (hissoh al-urudl), al-wasath (washath al-qamar), and al-markaz. The book advises careful arithmetic calculations, incorporating the precision of data collection and simple arithmetic. The current widely used method involves adding the smallest illumination time to the difference between the sun's and moon's longitudes, divided by the moon's hourly acceleration minus the sun's hourly acceleration, plus the correction for local time (WIB).

Due to the hourly data format in "Risalatul Qamarain," data interpolation (ta'dil baina sathrain) is necessary, involving the subtraction or addition of the initial sathr from the second sathr, multiplied by kasr al-mahfudz. This method aligns with modern interpolation techniques taught by contemporary celestial science educators. Additionally, the system provides an intriguing insight into estimating the dates and months of the Gregorian calendar by examining the Muqowwamus Syams (corrected sun position) and considering the zodiac sign values as Gregorian dates, subtracted by the difference in tafawut.

The findings of this calculation are specific to the city of Kediri. To adapt the Ijtima' data to other cities, a calculation is required to determine the fadl at-thulain (longitude difference), subtracting for eastward cities and adding for westward cities.

Concerning Haiatu Hilal, the book notes that the crescent moon's position varies based on the zodiac signs: lying for Dalwu, Huut, Haml, and Tsur (approximately January - April), inclined for Jauza', Sarathan, Asad, Qous, and Jadyu (May - July, November, and December), and upright for Sunbulah, Mizan, and Aqrob (approximately August - October). However, the author suggests that an upright crescent moon position is less likely in Java, particularly favoring a lying or inclined orientation based on his calculations.

Regarding Jihhatul Hilal, the book explains that the moon is positioned to the north when in Haml to Sunbulah (March - August) and to the south when in Mizan – Huut (September - February).

To calculate the irtifa' hilal (moon height), subtracting 24 hours (a day) from the Ijtima' time and multiplying or dividing the result by 30 minutes is suggested. However, the book acknowledges that this method oversimplifies the moon's journey, not accounting for factors such as the moon's speed at apogee and perigee, lunar parallax, semi-diameter, and horizon depression.

The calculation of qous nurul hilal (crescent moon width) involves summing the daqoiq urdlul qomar with daqoiq muktsul hilal, employing trigonometric formulas rather than the ephemeris system.

Lastly, Manzilah Qomar, indicating the moon's position at the time, is derived from Muqowwam Syams, aligning the moon with a zodiac sign. While modern astronomy no longer employs Manzilah Qomar, it remains informative for rukyat (moon sighting) practice.

Examining the data in the book "Wasilah Al Mubtadi'in," it is apparent that the information was sourced from the book "Fathur Rauf Al-Manan," with data specific to Kediri.

Table 2: Celestial Concepts in "Risālatul Qamaraīn"

Celestial Concept	Definition in "Risālatul Qamaraīn"	Corresponding Astronomical Term
Ijtima'	الإجتماع النيرين عبارة عن كونها في موضع واحد من فلك البروج	Conjunction - Sun and moon at the same longitude line
Buruj	Twelve constellations: Haml, Tsur, Jauza', Sarathan, Asad, Sunbulah, Mizan, Qous, Jadyu, Dalwu, Huut	Zodiac Signs - Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, Pisces

Celestial Concept	Definition in "Risālatul Qamaraīn"	Corresponding Astronomical Term
Muhaq	Loss of moonlight due to the moon positioned between the sun and earth	Lunar Eclipse Phenomena
Phases of Moon	Hilal (Crescent), Tarbi' Awal (First Quarter), Badr (Full Moon), Tarbi' Tsani (Last Quarter), Muhaq (Hidden)	Various Moon Phases
Sidereal & Synodic Month	Time for the moon to return to the same position: 27 days, 7 hours, 43 minutes, 4.30 seconds; Second conjunction: 29 days, 12 hours, 44 minutes, 2.26 seconds	Sidereal & Synodic Month - Lunar Orbit Periods
Haiatu Hilal	Crescent moon's position based on zodiac signs: Lying, Inclined, Upright	Crescent Moon Position Variations
Jihhatul Hilal	Moon's position based on zodiac signs: North or South	Moon's Position in Different Zodiac Signs
Irtifa' Hilal	Moon height calculation: Subtracting 24 hours from Ijtima' time, multiplied or divided by 30 minutes	Estimation of Moon's Height
Qous Nurul Hilal	Crescent moon width calculation: Summing daqoiq urdlul qomar with daqoiq muktsul hilal	Crescent Moon Width Calculation
Manzilah Qomar	Derived from Muqowwam Syams, indicating the moon's position aligned with a zodiac sign	Position of the Moon in a Zodiac Sign

Exploring Teaching Methods in the Book *'Wasīlah Al Mubtadi'īn Fī Tarjamati Risālatil Kamaraīn Fī Ijtimā'in Nayyiraīn*' on the Subject of Astronomy (Ilmu Falak)

Based on the information provided, although not explicitly stated, we can identify several possible learning methods employed in the book "Wasīlah Al Mubtadi'īn Fī Tarjamati Risālatil Kamaraīn Fī Ijtimā'in Nayyiraīn" to explore the science of astronomy:

1. **Arabic and Javanese (Pego) Language Approach:**

   The book uses Arabic and is subsequently translated into Javanese Arabic (Pego). This approach allows readers to better grasp the material through the local language, enhancing readability and facilitating understanding. In the book, the primary medium is the use of the Arabic language, which is later adapted or translated into Javanese Arabic (Pego). Examples of this evidence can be found in the text of the book that shows the use of both languages. For instance, a quote or paragraph in both languages can be presented to demonstrate this approach. The choice of words and phrases in Javanese Arabic (Pego) can also be identified as evidence of the use of this approach.

   Example: Quotation in Arabic: "الإجتماع النيرين عبارة عن كونها في موضع واحد من فلك البروج"
   Translation in Javanese Arabic (Pego): "*Ijtima' iku keadaan nek matahari lan rembulan ana ing ana ing sawijining garis bujur ing lingkaran zodiak*."

   Translation in English: *Ijtima' is When the sun and moon are on the same longitude line in the zodiac circle*

   By comparing the texts, it is evident that both Arabic and Javanese Arabic (Pego) are used concurrently in the book, supporting this approach to enhance reader comprehension through the local language.

2. **Focus on Basic Concepts:**

   Learning in this book revolves around fundamental concepts of astronomy, such as ijtima' (conjunction), the classification of buruj (zodiac), muhaq (loss of moonlight), and the journey of the synodic and sideral moon. This approach establishes a strong foundation in the understanding of basic astronomical principles.

The emphasis on fundamental concepts is evident in the book's focus on core astronomical principles, including ijtima' (conjunction), the categorization of buruj (zodiac), muhaq (loss of moonlight), and the journey of the synodic and sideral moon. This pedagogical approach is designed to lay a solid groundwork for comprehending essential astronomical principles. The evidence supporting this can be found within the book's content, where these fundamental concepts are likely explored and explained, contributing to a thorough understanding of basic astronomical principles.

3. **Historical and Traditional Approach:**
   The book appears to adopt a historical and traditional approach in presenting astronomical knowledge. This is evident in the use of classical terminology and concepts rooted in the classical astronomical tradition.
4. **Case-Based Learning:**
   By discussing calculations for the estimated occurrence of lunar eclipse phenomena and explanations of the timing of ijtima', readers can learn through concrete cases. This can aid in a more thorough and applicable understanding.
5. **Step-by-Step and Detailed Explanation:**
   Learning in this book is presented in a step-by-step manner, offering detailed explanations of astronomical concepts and calculation procedures. This approach helps readers comprehensively understand each step in astronomical calculations.
6. **Use of Astronomical Data and Arithmetic:**
   Astronomy learning in this book involves the utilization of astronomical data, such as the calculation of ijtima' time and lunar eclipse phenomena. The use of simple arithmetic, data interpolation, and other mathematical concepts creates a scientific and measurable approach.
7. **Emphasis on Local Application:**
   The book includes specific information about markaz Kediri, encouraging readers to adapt calculations based on their respective geographic locations. This underscores an emphasis on local application and relevance in understanding astronomy.

It is important to note that although the book does not explicitly enumerate teaching methods, the outlined characteristics provide an overview of a learning approach designed for continuity, readability, and understanding of basic concepts, utilizing a traditional and applicable methodology.

Conclusion

The book "*Wasīlah Al Mubtadi'īn Fī Tarjamati Risālatil Kamaraīn Fī Ijtimā'in Nayyiraīn*" presents a comprehensive approach to learning celestial science, covering fundamental concepts, intricate calculations of the lunar month initiation, and detailed explanations of astronomical phenomena. Utilizing classical Arabic terms explained in Javanese Arabic (pego), the book maintains a connection with traditional celestial science while ensuring local accessibility. Emphasizing the disparities between sidereal and synodic months, the text integrates practical applications of arithmetic and trigonometric principles. Notably, the acknowledgment of multiple sources indicates a broad approach to celestial science education, and the inclusion of practical information fosters a balance between theoretical and applied knowledge, aligning the study with both classical and modern perspectives in celestial science.

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