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USING ALGORITHM JEAN MEUUS AND SOLRAD SIMULATION APPLICATION IN DETERMINING EARLY MONTHS QAMARIYAH

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Abstract

In terms of determining the beginning of the month Qamariah required reasoning of astronomy, Science of this is one area of science that is recommended to be studied in order to determine it Muslim worship such as fasting, Eid-ul-Fitr, Hajj, and others - others. Practically Science of Falak is widely used to determine the direction of Qibla (Direction Muslim prayers) from a place far from the place where it can not directly see the Ka'bah (the reference point for determining the direction Muslims worship Shalaf). Science of Falak is also useful for determining the beginning of the month or the 1st of every month for Qamariyah (Years by or determined by the circulation of the month). A large difference in determining Qamariah beginning is often the case in Indonesia and a debate every year, for that to be expected with this research is to help Jean Meuus and Solrad algorithms in the form of simulator applications can help in the early months of Qomariah determine the support of Data Ephemeris Sun and moon obtained from several options algorithms accurately recognized by the astronomical community, early calculations using solar Ephemeris data method in accordance with the calculation in the Department of Religious Affairs in the State of Indonesia.

Keyword : Qamariyah, Science of Falak, Jean Meuus algorithms, algorithms Solrad.

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1. INTRODUCTION

Hisab Rukyat also known as Falak science. According to the language (etymology) means Falak orbits or trajectories of heavenly bodies, so that astronomy is a science that studies the track objects - celestial bodies particularly earth, moon, and sun in their respective orbits in order to know the positions of celestial bodies with each the other, in order to know the time - the time at the Earth's surface, with the slope of the ecliptic to the equator, causing the sun's declination. Calculation formula can be found in Jean Meuus algorithm but it can not be found in the algorithm Solrad. However, suppose instead to search formulas Anomaly Longitude Sun. The calculation formula can not be found in algoriima Jean Meuus, but can be found in the algorithm Soirad.

2. METHODS.

To calculate accurately the beginning, a lot of variables that will be needed. Therefore the need to explain the basic - basic data calculation sun and the moon in order to make the calculation beginning Qamariyah

CALCULATION FORMULAS QAMARIYAH MONTHS EARLY

Once the data - data obtained Ephemeris sun and moon. Then it can do calculations to determine the beginning of the month Qamariyah.

There are several ways to do early perhtiungan Qamariyah. Among them:

a. The derivation of the Ministry of Religious Affairs

Department of Religion provides a standard reference in determining the beginning of the month Qamariyah. Department of Religion retrieve Ephemeris sun.

Step - step to determine the beginning of the month Qamariyah by your Department of Religion can be summarized by the researcher as follows:

1. Determining what the beginning of the month and year did (Hijriyah) to be calculated.
2. Determination for the location or city where, Find Data Latitude place (φ) and Longitude Points (λ) for the relevant locations and High Points of the sea.
3. Counting the 29 months (Hijriyah) coincides with the previous month according to the Gregorian calendar date the Conversion Date or by comparison chronicle.
4. Astronomical Data Set on the AD or the day before, which happens when FIB (Fraction Illumination months) smallest .
5. Track the smallest FIB on the relevant date occurs at what time (Greenwich time)
6. Counting Sabaq sun (B1) ie sun hourly rate, by calculating the difference (absolute value) between the data ELM (ELM = Ecliptitic Longitude Sun) at the smallest FIB TSB and the next hour.
7. Counting Sabaq month (B2) in the hourly rate, by calculating the difference (absolute value) between the data ALB (ALB = Apparent Longitude Month) at the smallest FIB TSB and the next hour.
   Note When FIB smallest occurred at 24 then the next hour is 01 hours at a later date.
8. Calculate the distance the sun and moon (MB) by the formula:
   $$MB = ELM - ALB$$
   (data ELM and ALB at least FIB).
9. Counting Month Sabak Mu'adal (SB), the velocity relative to the solar months, according to the formula :
   $$SB = B2 - B1$$
10. Calculating point Ijtima' with the formula :
    $$\text{Titik Ijtima'} = MB : SB$$

11. Calculating time astral conjunction '(according to GMT), according to the formula :

$$\text{Ijtima'} = \text{Waktu FIB} + \text{Titik Ijtima'}$$

If desired add 7 hours ago (105 º: 15).

Estimating at sunset under GMT on ijtima' for the place specified above.

These estimates can be tracked through the Nautical Almanac counting or counted separately as maghrib time without ikhtiyat.

12. Keep track of the following data from the Ephemeris estimated at sunset above (no.12) according to Greenwich time by interpolation.
    a) Declination Solar (δo) Apparent Declination Sun column..
    b) Semi Solar Diameter (Do) Diameter Semi solar ponds
    c) Equation of Time (e) in the Equation of Time

    Note When the astral conjunction 'by the time the area has changed the date, then use the data the sun and the moon at a later date..

14. Calculating High Sun (ho) with the formula :

$$ho = -(SDo + 0° 34' 30'' + Dip)$$

15. Counting Time the Sun angle (to) by the formula :

$$\cos to = -\tan \varphi \tan \delta o + \sin ho : \cos \varphi : \cos \delta o$$

16. Calculate the sunset time (Ghurub) according to the formula GMT :

$$Ghurub = 12 - e + (to : 15) - (\lambda : 15)$$

To add 7 hours ago

17. Counting Asensio rekta Sun (ARO column Apparent Right Ascension Sun) at sunset in Greenwich time by interpolation .
18. Counting Asensio rekta months (AR ☾ on Apparent Right Ascension Month column) at sunset, according to Greenwich time by interpolation.
19. Counting Month Declination (δ☾) in column Apparent Declination Moon at sunset, according to Greenwich time by interpolation
20. Calculate Semi Diameter Month (SD☾) Diameter Semi Month column at sunset by Greenwich time by interpolation
21. Calculating Horizontal Parallaks Month (HP☾) in the Horizontal Parallax at sunset according to Greenwich time by interpolation
22. Calculating Angle Month Time (t☾) by the formula:

$$t☾ = ARo - AR☾ + to$$

23. Calculating the intrinsic high hilal (h☾) with the formula :

$$\sin h☾ = \sin \varphi \sin \delta☾ + \cos \varphi \cos \delta☾ \cos t☾$$

24. Counting Month Parallax (P☾) with the formula:

$$P☾ = \cos h☾ \; HP☾$$

25. Calculating High Hilal (ho)

$$ho = h☾ - P☾ + SD☾$$

26. Counting refraction (Refr) with the formula:

$$Refr = 0.0167 : \tan (ho + 7.31 : (ho + 4.4))$$

Or traceable to an existing table based on ho (Note the interval between two data)

27. Calculating High Hilal mar'i (h☾') by the formula :

$$H☾' = ho + Refr + Dip$$

If the result potitif (+), then the moon is above the horizon mar'i.
If the result is negative (-), then the moon is below the horizon mar'i.

28. Counting Nisful Fudlah Month (NF☾) by the formula :

$$\sin NF☾ = (\sin \varphi \ \sin \delta☾) : (\cos \varphi \ \cos \delta☾)$$

29. Calculates Parallax Nisful Fudlah (PNF) with the formula :

$$PNF = \cos NF☾ \ HP☾$$

30. Calculating Half Moon Bows Spot Essential (SBSH) with the formula

$$SBSH = 90 + NF☾$$

31. Calculating Half Moon Bows Spot (SBS☾) by:
32. If SBSH> = 90 then use the formula :

$$SBS☾ = 90 + NF☾ - PNF + (SD☾ + .575 + Dip)$$

If SBSH <90 then use the formula :

$$SBS☾ = 90 + NF☾ + PNF - (SD☾ + .575 + Dip)$$

33. Calculating Duration Hilal (Lm☾) with the formula :

$$Lm☾ = (SBS☾ - t☾) : 15$$

34. Calculating time Immersed Hilal (Terb☾) by the formula :

$$Terb☾ = Ghurub + Lm☾$$

35. Calculating Directions Sun (Ao) with the formula :

$$\tan Ao = -\sin \varphi : \tan to + \cos \varphi \ \tan \delta o : \sin to$$

36. Counting Direction Hilal (A☾) by the formula :

$$\tan A☾ = -\sin \varphi : \tan t☾ + \cos \varphi \ \tan \delta☾ : \sin t☾$$

If the result is positive (+), the sun or the moon in the northern West Titiek
If the result is negative (-), the sun or the moon in the south western point

36. Calculating Position Hilal (PH)

$$PH = A☾ - Ao$$

a. If the result poitif (+), then the new moon in the northern sun
b. If the result is negative (-), the moon is in the southern sun

37. Counting Direction Immersed Hilal (AT☾) by the formula :

$$\tan AT☾ = -\sin \varphi : \tan SBS☾ + \cos \varphi \ \tan \delta☾ : \sin SBS☾$$

38. Counting Area Light Hilal (FI☾) Moon Illumination Fraction Seen column) at sunset (Greenwich time) by means of interpolation..
39. Calculating Width Nurul Hilal (NH) with a unit of measure usbu 'can be calculated using the formula:

$$NH = (\sqrt{[PH2 + h☾' 2]}) : 15$$

40. Calculate the slope of the hilal (MRG) with the formula

$$\tan MRG = [PH : h☾']$$

If MRG <= 15 then hilal supine
If MRG> 15 and PH positive then the moon is tilted to the north
If MRG> 15 and PH negative then the moon is tilted to the south

3. RESULTS AND DISCUSSION.

3.1 *Calculation results Qamariyah Early Months*

Early calculations Month Qamariyah According to the guidelines by the Ministry of Religious Affairs analysis calculation functions - Sun and Moon Data functions, as described previously.

To determine the beginning of the month Qamariyah necessary steps - steps as follows :

1. Collect data on the location where observed, Suppose :

    Location = Jakarta

The latitude (p-phi) = 6 ° 10 '0 "LS
The longitude (lambda) = 6 ° 49 '0 " BT
High Points = 28 meters above sea

2. Calculating estimates (Hisab Urfi) end of Ramadan 1424 H
   On 29 Ramadan 1424 H
   > So until a specified date are: 1423 years + 8 months + 29 days
   Hijri year first cycle was: 30 years old
   1 cycle of the Hijri year is: **10 631** days
   Leap year cycle in 1 year Hijri Hijri (30 Years) is defined in the : 2,5,7,10,13,16,18,21,24,26,29
   The number of days in a year Basitah (Not a leap year) are: 354 days
   The number of days in a Leap year is: 355 days
   > So the year 1423/30 year cycle = 47 + 13 years + 8 months + 29 days
   > Many days in 47 cycles were: 47 cycles x 10 631 days = 499,657 days
   > Many leap years in the rest of the year are: 5 pieces
   > Many days in the rest of the year (13 years) for the year Basitah was **13 years x 354 days** = 4602 days
   > Many days in the rest of the year (13 years old) is a whole day for the whole year plus Basitah with many days over Leap year: 4602 days + 5 days = 4607 days
   In Basitah Hijri, last month (Dhu al-Hijjah) was 29 days
   Leap year Hijri, last month (Dhu al-Hijjah) to 30 days
   Another month alternating between 30 days and 29 days
   The first month (Muharram) were 30 days. Second month (Safar) amounted to 29 days. And so on
   > Many days in the rest of the month is**: 236 days**
   > Many of the rest of the day is: **29 days**
   > So the number of whole days until the specified date is :
   > = (47 cycles x 10 631 days) + ((13 years x 354 days) + 5 days) + (236 days + 29 days)
   > 499 657 days = 4607 days + 236 days + 29 days
   > = 504 529 days

The number of days from the first year until the first Hijriah (Already calculated)
as: 227 029 days
> So much throughout the day from the first year Masehi until a specified date is
:504529 day + 227029 day = 731558
1 cycle of the solar year is: 4 years
The number of days in the fourth year of our Lord is (It's calculated): 1461 days
> So the day 731 558/1461 days = 500 + 2-year cycle + 10 months + 24 days
> = 24 November 2003 M
.:. So the 29th of Ramadan 1424 H = 24 November 2003 M.

3. Calculating when Ijtima' end of Ramadan 1424 H
   a. Illumination Fraction Month (FIB) smallest of date 23 November 2003 s / d On 25 November 2003 is :
      = 8.3150661606135E-07. Occurred on 23 November 2003. At 23:00 GMT
   b. Sun on the Ecliptic Longitude At 23:00 GMT = 241° 13' 56.93861"
   c. Apparent Longitude Month (ALB) at 23:00 o'clock GMT = 241° 13' 47.49575"
   d. Sabaq sun per hour :
      Ecliptic Longitude Sun (ELM) at 23:00 o'clock GMT = 241° 13' 56.93861"
      Ecliptic Longitude Sun (ELM) at 0:00 o'clock GMT (Date 24) = 241° 16' 28.62195"
      Sabaq Sun (SM) = 0° 2' 31.68334"
   e. Sabaq Month per hour :
      Apparent Longitude Month (ALB) at 23:00 o'clock GMT = 241° 13' 47.49575"

Apparent Longitude Month (ALB) on At 0:00 GMT (Date 24) = 241° 51' 54.47446"
Sabaq Month (SB) = 0° 38' 6.978706"

f. Ijtima' :
The formula to find the time Ijtima' 'is :
= (FIB Hours in GMT) + (ELM - ALB) / (SB-SM) + (Local Time ie 7:00 pm)
= 23° 0' 0" GMT + (241° 13' 56.93861" - 241° 13' 47.49575") / (0° 38' 6.978706" - 0° 2' 31.68334") + (7:00 WIB)
= 23° 0' 0" GMT + (0° 0' 9.44286") / (0° 35' 35.29537") + (7:00 WIB)
= 23° 0' 0" GMT + (0° 0' 15.92018") + (7:00 WIB)
= 6° 0' 15.92018" WIB

4. Calculating the position and state of the end of Ramadan 1424 H Hilal
   a. Ijtima' Last : Ramadan 1424 H. Occurred on 24 November 2003 Date of M. o'clock 6° 0' 15.92018" WIB
   b. Looking for the sun angle (t0) at sunset :
   Declination (and) the sun At 11:00 GMT = -20° 30' 36.92951"
   Straighten Time / Equation Of Time (e) of the sun At 11:00 GMT = 0° 13' 26.69778"
   Semi Diameter (Sd) = 0° 16' 11.91867"
   Refractory (Ref) = 0° 34' 30"
   Humility Ufuk (D ') = 0° 9' 18.78268"
   Correction local time (KWD) = 0° -7' 16"
   High Formula Sun :
   h° = 0° - Sd - Ref - D'
   h° = 0° - Semi Diameter - refraction - Humility Ufuk
   h° = 0° - 0° 16' 11.91867" - 0° 34' 30" - 0° 9' 18.78268"
   = -1° 0' 0.7013435"
   Angle Formulas Time :
   cos(t) = -tan(p).tan(d) + sin(h)/cos(p)/cos(d)
   cos(t) = -tan (Latitude place.) and (Declination Sun) + sin (High Sun) / cos (LintangTempat) / cos (Declination Sun)
   cos(t) = -tan(-6° 10' 0").tan(-20° 30' 36.92951") + sin(-1° 0' 0.7013435")/cos(-6° 10' 0")/cos(-20° 30' 36.92951")
   cos(t)= 0.108046159231996.-0.374088760338179 + -0.0174558061287302/0.994213627204956/0.93660947334245
   cos(t) = -3.3898792021894
   t = 93.3918600045329
   t = 93° 23' 30.69602"
   t/15 = 93° 23' 30.69602"/15
   t/15 = 0 day, 6 hour, -13 minute, 34.0464 second
   c. Finding scat sunset :
   formula = 12 - e + t – Kwd
   = 12 00 00 - 0° 13' 26.69778" + 6° -13' 34.0464" + 0° -7' 16"
   sunset = 5:25:43.25582
   d. Looking asensiorekta / right ascension (AR) Sun and Moon :
   To calculate the right ascension sun and moon, with the interpolation
   formula: A - (A-B) x C / difference in Hours
   AR o'clock 10 GMT = 239° 35' 17.24745"
   AR o'clock 10 GMT = 239° 37' 55.90781"
   o'clock 5° 25' 43.25582" = 239° 35' 17.24745" - (239° 35' 17.24745" - 239° 37' 55.90781") x 0° 25' 43.25582"/ 1 = 239° 36' 25.26232"

AR sun = 239° 36' 25.26232"
AR o'clock 10 GMT = 246° 11' 1.765745"
AR o'clock 10 GMT = 246° 51' 23.52769"
o'clock 5° 25' 43.25582" = 246° 11' 1.765745" - (246° 11' 1.765745" - 246° 51' 23.52769") x 0° 25' 43.25582"/ 1 = 246° 28' 19.93191"
AR Moon = 246° 28' 19.93191"

e. Looking corner of months (t_Moon) :
t_Moon = AR Sun - OR Moon + Sun Angle Time
t_Moon = 239° 36' 25.26232" - 246° 28' 19.93191" + 93° 23' 30.69602"
t_Moon = 86° 31' 36.02642"

f. Looking declination month (d'Moon) :
To calculate the declination months, with the interpolation
Formula: A - (A - B) x C / Difference in Hours
Declination Month At 10 GMT = -23° 16' 17.21895"
Declination Month At 11 GMT = -23° 25' 37.69982"
o'clock 5° 25' 43.25582" = -23° 16' 17.21895" - (-23° 16' 17.21895" - -23° 25' 37.69982") x 0° 25' 43.25582"/ 1 = -23° 20' 17.4871"
declination Month = -23° 20' 17.4871"

g. Finding high intrinsic month (h_Moon) :
Formula: sin(h_moon) = sin(p).sin(d) + cos(p).cos(d).cos(t_Moon)
= sin(p).sin(d_Moon) + cos(p).cos(d_Moon).cos(t_Moon)
= sin(-6° 10' 0").sin(-23° 20' 17.4871") + cos(-6° 10' 0").cos(-23° 20' 17.4871").cos(86° 31' 36.02642")
= 5° 36' 25.23644"
h_Moon = 5° 36' 25.23644"

h. Finding high view / mar 'i months (See Moon) :
Horizontal Parallax (HP_Moon) = 1° 1' 24.79034"
Semi Diameter (sd Moon) = 1° 1' 24.79034"
Essential Month High (h_Moon) = 5° 36' 25.23644"
Formula : Parallax = cos(h_Moon) x HP_Moon
= 1° 1' 7.103763"
High View (See Moon) = High Hakiki - Parallax Semi Diameter Month + Refraction Ufuk Humility
= 5° 36' 25.23644" - 1° 1' 7.103763" + 0° 16' 44.031" + 0° 9' 42" + 0° 9' 18.78268"
= 5° 11' 2.94635"

i. Finding Azimuth (A) Sun and Moon :
1) Azimuth Solar
Cotan(A) = -sin(p) / tan (t) + cos(p).tan(d) / sin(t)
Cotan(A) = -sin(-6° 10' 0") / tan (93° 23' 30.69602") + cos(-6° 10' 0").tan(-20° 30' 36.92951") / sin(93° 23' 30.69602")
Cotan(A) = -21° 42' 42.70211"
A = -20° 45' 13.95422" measured from a point west to south
2) Azimuth Month
Cotan(A) = -sin(p) / tan (t_Moon) + cos(p).tan(d_Moon) / sin(t_Moon)
Cotan(A) = -sin(-6° 10' 0") / tan (86° 31' 36.02642") + cos(-6° 10' 0").tan(-23° 20' 17.4871") / sin(86° 31' 36.02642")
Cotan(A) = -24° 14' 57.72746"
A = -22° 56' 22.57285" measured from a point west to south
Note :

a) If the azimuth is minus (-), the azimuth is calculated from the south to western point (S-B)
b) If the azimuth is positive (+), the azimuth is calculated from points north to a point west (U-B)

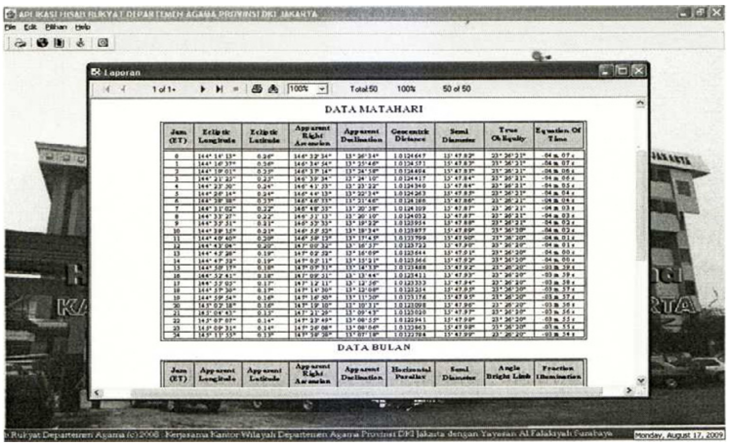
j. Location and position of moon hilal :
Location and position of the new moon in the southern hemisphere and in the southern sun, so far 2° 11' 8.618629", with the state of North East tilt (247° 51' 23.28097")

k. Conclusion :

1) Ijtima' Last : Ramadhan 1424 H. Occurred on 24 November 2003 Date of M. o'clock 6° 0' 15.92018" WIB
2) At Sunset sun 5:25:43.25582
3) High hilal essential : 5° 36' 25.23644", High hilal see / mar 'i : 5° 11' 2.94635"
4) Old moon above ufuq :
5) Azimuth Solar : -20° 45' 13.95422" measured from a point west to south
azimuth Month : -22° 56' 22.57285" measured from a point west to south
6) The location and position of the moon is in the southern hemisphere and in the southern sun, so far 2° 11' 8.618629", with the state of North East tilt (247° 51' 23.28097")
7) On 1 Ramadan 1424 H. Estimated to fall on: 25 November 2002 M.

3.2 *Design Simulation Applications..*

Draft Screen Display Interface Applications



Picture 1
Screenshots simulation application program

When the application is run or executed it will mmuncul application's main menu as shown above. The main menu consists of:

1. File Menu: Contains menu - navigation menu that will display the form - form that contains the facility - a facility that is in this application
2. Toolbar: Contains the icon - the icon that when click will display or-working process immediately. Functions that functions that are often used in applications can be quickly accessed.
3. Workspace: This is a work in which form - form that contains facilities - facilities that exist in these applications are placed.

4. Statusbar: This is information for the application is started. For example, to display the status when the old calculation process is ongoing.
5. Form the beginning of the calculation: This is the most important form in the discussion of this application. Where in this form, the user fills in the data for the initiation of early calculations do Qamariyah. Daiam menu or form, consists of several control transfer calculation results into Excel format.

5. CONCLUSIONS.

CONCLUSIONS

1. As the results of the field observations are expected to debate the calculation process reduces early Qamariyah in Jakarta by the Agency team Reckoning Rukyat Jakarta Regional Office of the Department of Religious Jakarta using this simulation application and the method of calculating Ephemeris Rukyat Reckoning, but in terms of the initial calculations in Qamariyah using eksirapolasi.
2. In calculating the initial months of Qamariyah to a particular location, the BHR team agreed to use Ephemeris data calculation formula that has been studied by working with the Department of Astronomy sarna Bandung Institute of Technology, where the algorithm comes from Russia.
3. Qamahyah early computing applications give you the option to use the Ephemeris data calculation method based on algorithms Jean Meuus or by using the algorithms of the Department of Ecology Solrad VI.2 America.
4. Panentuan beginning Qamariyah influenced by several important factors such as the location (time, latitude places, longitude points, and altitude).
5. The start of the month Qamariyah use help rnatahari and months. So by knowing the position of the sun and moon can be determined from the beginning of the month Qamariyah.

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