Vaisnava Events Calculation in GCAL

This is the summary of calculation of the vaisnava events in the GCAL program. Algorithms are described "as they are" implemented in program and are not for definition of particular event in vaisnava calendar.

Contents

Calculation Calculation

1 Calendar Calculation

Calendar calculation is always performed on given range of dates <date1, dateN>. Calculation is done in phases. For one phase is performed specific calculation for whole range of dates.

Phases:
- calculation of tithi, paksa, naksatra, yoga
- calculation of masa
- calculation of dvadasi
- calculation of ekadasi
- calculation of ekadasi parana (breaking fast)
- calculation of appearance days
- calculation of depending appearance days
- resolution of fasting days
- calculation of sankrantis
- calculation of events depending on sankrantis
- calculation of exact time for ksaya tithis
- correction of calculated times according DST

1.1 Calculation of tithi, paksa, naksatra, yoga

This calculation is described in document "Astronomical Calculations in GCAL". Preformed for each and every day in range.

1.2 Calculation of masa

Process of this calculation is described in document "Astronomical Calculations in GCAL". Masa is calculated only for pratipat tithi (two times in month). All next days up to Purnima or Amavasya Tithi have the same masa. If pratipat tithi is ksaya, then masa is calculated for dvitiya tithi. If pratipat tithi is vriddhi, then masa is calculated for first day of tithi.

1.3 Calculation of dvadasi

This tests are performed only for days when today's tithi is Dvadasi and yesterday's tithi is less than Dvadasi (Ekadasi or Dasami).

test1.3.1

if today is GauraDvadasi and *naksatra_test* is successful

then this day1 is Naksatra Mahadvadasi

otherwise perform next test

test 1.3.2

> **if** today is Dvadasi and tomorrow is Dvadasi and yesterday is Suddha Ekadasi
>
> **then** this day1 is VYANJULI MAHADVADASI
>
> **otherwise** perform next test

test 1.3.3

> **if** today is Dvadasi and next pratipat or amavasya tithi is vriddhi (last 2 days)
>
> **then** this day1 is PAKSAVARDHINI MAHADVADASI
>
> **otherwise** perform next test

test1.3.4

> **if** today is Dvadasi and yesterday on arunodaya is less than ekadasi
>
> **then** today is Dvadasi suitable for Fasting

Naksatra test:

Today				Tomorrow		Today Mahadvadasi
Sunrise		Sunset		Sunrise		
Naksatra	Tithi	Naksatra	Tithi	Naksatra	Tithi	
Sravana	Gaura Dvadasi	-	-	Sravana	-	Vijaya
Punarvasu	Gaura Dvadasi	-	Gaura Dvadasi	Punarvasu	-	Jaya
Rohini	Gaura Dvadasi	-	Gaura Dvadasi	Rohini	-	Jayanti
Pusyami	Gaura Dvadasi	-	Gaura Dvadasi	Pusyami	-	Papa nasini

Table 1 sumarizes decision logic for Dvadasi day.

Yesterday (arunodaya)	Yesterday (sunrise)	Today (sunrise)	Tomorrow (sunrise)	Today Fast
-	less than dvadasi	gaura dvadasi	-	if naksatra_test is positive, then result is related Mahadvadasi
ekadasi	ekadasi	dvadasi	dvadasi	today is Vyanjuli Mahadvadasi
-	less than dvadasi	dvadasi	-	here performed tests for next full or new moon: if vriddha then Paksavardhini Mahadvadasi
less than ekadasi	less than dvadasi	dvadasi	-	Today Fast for Ekadasi

1.4 Calculation of ekadasi

This calculation is performed only for Ekadasi Tithi days.
That means we are testing day1, which is Ekadasi Tithi.

Table 2 shows decision table for determining type of Ekadasi.

Yesterday (arunodaya)	Yesterday (sunrise)	Today (arunodaya)	Today (sunrise)	Tomorrow (sunrise)	Today Fast
-	-	dasami	ekadasi	-	not suitable for fast
ekadasi	ekadasi	ekadasi	ekadasi	trayodasi	Unmilani Trisprsa Mahadvadasi
ekadasi	ekadasi	ekadasi	ekadasi	dvadasi	Unmilani Mahadvadasi
not ekadasi	-	ekadasi	ekadasi	trayodasi	Trisprsa Mahadvadasi
-	-	ekadasi	ekadasi	ekadasi	not suitable for fast (tomorrow is Unmilani)
-	-	ekadasi	ekadasi	some mahadvadasi	not suitable for fast
not ekadasi	-	ekadasi	ekadasi	dvadasi	Suddha Ekadasi

1.4.1 Calculation of ekadasi parana

There are 7 types of Ekadasi day and related parana time.

1. Normal - fasting day has ekadasi at sunrise and dvadasi at next sunrise.

2. Viddha - fasting day has dvadasi at sunrise and trayodasi at next sunrise, and it is not a naksatra mahadvadasi

3. Unmilani - fasting day and previous day has ekadasi at sunrise.

4. Vyanjuli - fasting day has dvadasi at both sunrises, and it is not a naksatra mahadvadasi.

5. Trisprsa - fasting day has ekadasi at sunrise and trayodasi at next sunrise.

6. Jayanti/Vijaya - fasting day has gaura dvadasi and Rohini/Sravana naksatra at sunrise and same naksatra at next sunrise.

7. Jaya/Papanasini - fasting day has gaura dvadasi and Punarvasu/Pusya naksatra at sunrise and same naksatra at next sunrise.

Case 1: Normal

If dvadasi tithi ends before 1/3 of daylight
    then PARANA END = TIME OF END OF TITHI
but if dvadasi TITHI ends after 1/3 of daylight
    then PARANA END = TIME OF 1/3 OF DAYLIGHT

if 1/4 of dvadasi tithi is before sunrise
    then PARANA BEGIN is sunrise time
but if 1/4 of dvadasi tithi is after sunrise
    then PARANA BEGIN is time of 1/4 of dvadasi tithi

if PARANA BEGIN is before PARANA END
    then we will write "BREAK FAST FROM xx TO yy
but if PARANA BEGIN is after PARANA END
    then we will write "BREAK FAST AFTER xx"

Case 2: Viddha

If trayodasi tithi ends before 1/3 of daylight
   then PARANA END = TIME OF END OF TITHI
but if trayodasi TITHI ends after 1/3 of daylight
   then PARANA END = TIME OF 1/3 OF DAYLIGHT

PARANA BEGIN is sunrise time

we will write "BREAK FAST FROM xx TO yy

Case 3: Unmilani

PARANA END is end of Dvadasi tithi or 1/3rd of daylight hours, whichever is earlier

PARANA BEGIN is sunrise

We write "BREAK FAST FROM xx TO yy

Case 4: Vyanjuli

PARANA BEGIN = Sunrise

PARANA END is end of Dvadasi tithi or 1/3 of daylight hours, whichever is earlier

we will write "BREAK FAST FROM xx TO yy

Case 5: Trisprsa

PARANA BEGIN = Sunrise

PARANA END = 1/3 of daylight hours

we will write "BREAK FAST FROM xx TO yy

Case 6: Jayanti/Vijaya

If the dvadasi tithi is present at sunrise and the naksatra ends before the dvadasi tithi and before 1/3 of daylight hours, then PARANA BEGIN = end of naksatra and PARANA END = end of dvadasi tithi or 1/3 of daylight hours, whichever is earlier.

   then we will write "BREAK FAST FROM xx TO yy"

If the dvadasi tithi is present at sunrise and the naksatra ends before the dvadasi tithi but after 1/3 of daylight hours then PARANA BEGIN = end of naksatra and PARANA END = end of dvadasi tithi.

   then we will write "BREAK FAST FROM xx TO yy"

If the dvadasi tithi is present at sunrise and the naksatra ends after the dvadasi tithi then PARANA BEGIN = sunrise and PARANA END = end of dvadasi tithi or 1/3 of daylight hours, whichever is earlier.

   then we will write "BREAK FAST FROM xx TO yy"

If the dvadasi tithi is not present at sunrise, then PARANA BEGIN = sunrise and PARANA END = end of naksatra or 1/3 of daylight hours, whichever is earlier.

then we will write "BREAK FAST FROM xx TO yy"

Case 7: Jaya/Papanasini

If the dvadasi tithi is present at sunrise and the naksatra ends before the dvadasi tithi and before 1/3 of daylight hours, then PARANA BEGIN = end of naksatra and PARANA END = end of dvadasi tithi or 1/3 of daylight hours, whichever is earlier.

   then we will write "BREAK FAST FROM xx TO yy"

If the dvadasi tithi is present at sunrise and the naksatra ends before the dvadasi tithi but after 1/3 of daylight hours then PARANA BEGIN = end of naksatra and PARANA END = end of dvadasi tithi.

   then we will write "BREAK FAST FROM xx TO yy"

If the dvadasi tithi is present at sunrise and the naksatra ends after the dvadasi tithi then PARANA BEGIN = sunrise and PARANA END = end of dvadasi tithi or 1/3 of daylight hours, whichever is earlier.

   then we will write "BREAK FAST FROM xx TO yy"

If the dvadasi tithi is not present at sunrise and the naksatra ends before 1/3 of the daylight hours, then PARANA BEGIN = end of naksatra and PARANA END = 1/3 of daylight hours.

   then we will write "BREAK FAST FROM xx TO yy"

If the dvadasi tithi is not present at sunrise and the naksatra ends after 1/3 of the daylight hours, then PARANA BEGIN = end of naksatra.

   then we will write "BREAK FAST AFTER xx"

1.5 Calculation of appearance days

Tests for build-in festival calculations:

test 1.5.1 – Govardhana Puja

if day is in damodara masa, gaura paksa, then perform following test 1.5.1

if today and yesterday is gaura pratipat

then do nothing (Govardhana Puja was resolved when yesterday was tested)

if today and tomorrow is gaura pratipat

then   if moon rises between todays sunrise and tomorrow's sunrise

        then today is Govardhana Puja

        otherwise Govardhana Puja is tomorrow

if just today is gaura pratipat

then today is Govardhana Puja

test 1.5.2 – Sri Krsna Janmasthami

This test if performed when masa is Hrsikesa. First we are testing present tithi.

Yesterday	Today	Tomorrow	Decision
saptami	astami	navami	today is Janmasthami
saptami	navami	any	today is Janmasthami
astami	astami	navami	need to perform test 1.5.2.1
saptami	astami	astami	need to perform test 1.5.2.1

Last two lines seems to be the same case, but if navami or saptami is ksaya, then both of these lines are needed. If test in 3rd line is succesfull, then last line is skipped, so no double testing is performed.

test 1.5.2.1

Day1 sunrise naksatra	Day2 sunrise naksatra	Decision
not rohini	not rohini	need to perfrom test 1.5.2.2
rohini	not rohini	day1 is janmasthami
not rohini	rohini	day2 is janmasthami
rohini	rohini	need to perform test 1.5.2.3

test 1.5.2.2

Day 1	Day 2	Decision
monday	tuesday	day1 is janmasthami
tuesday	wednesday	day2 is janmasthami
wednesday	thursday	day1 is janmasthami
thursday	friday	day1 is janmasthami
friday	saturday	day1 is janmasthami
saturday	sunday	day1 is janmasthami
sunday	monday	day2 is janmasthami

test 1.5.2.3

Day1 midnight naksatra	Day2 midnight naksatra	Decision
not rohini	not rohini	need to perfrom test 1.5.2.2
rohini	not rohini	day1 is janmasthami
not rohini	rohini	day2 is janmasthami
rohini	rohini	need to perform test 1.5.2.2

test 1.5.3 – Ratha Yatra

This is performed in Vamana Masa.

Yesterday	Today	Tomorrow	Decision
less than Dvitiya	Gaura Dvitiya	any	today is Ratha Yatra
Gaura Pratipat	Gaura Tritiya	any	today is Ratha Yatra
Gaura Dvitya	Gaura Dvitiya	any	yesterday is Ratha Yatra

test 1.5.4 – Gaura Purnima

This is performed when yesterday is in Govinda Masa.

Yesterday	Today	Decision
less than Purnima (Govinda Masa)	Purnima (Govinda Masa)	today is Gaura Purnima
less than Purnima (Govinda Masa)	Krsna Pratipat (Visnu Masa)	today is Gaura Purnima
Purnima (Govinda Masa)	Purnima (Govinda Masa)	yesterday is Gaura Purnima

test 1.5.5 – Rama Navami

This test is performed in Visnu Masa, Gaura Paksa.

Yesterday	Today	Tomorrow	Decision
Astami	Navami	Dasami	today is Rama Navami
Astami	Navami	Navami	today is Rama Navami
Astami	Dasami	Dasami	today is Rama Navami
Astami	Dasami	Not suitable for Ekadasi fasting	today is Rama Navami
Astami	Dasami	Suitable Ekadasi for fasting	yesterday is Rama Navami

test 1.5.5 – Test for other festivals

There is a list of festivals and events and for each and every event is performed the same test. For example we have event which occurs on tithi, before was tithi-1 and after is tithi+1.

Yesterday	Today	Tomorrow	Decision
tithi-1 or less	tithi	tithi+1	event is celebrated today
tithi-1	tithi+1	any	event is celebrated today
any	tithi	tithi	event is celebrated today

1.6 Calculation of depending appearance days

Event	Offset to	Event
Srila Prabhupada Appearance	1 day after	Janmasthami
Gundica Marjana	1 day before	Ratha Yatra
Hera Pancami	4 days after	Ratha Yatra
Return Ratha	8 days after	Ratha Yatra
Jagannatha Misra festival	1 day after	Gaura Purnima

1.7 Resolution of fasting days

If (*today is Ekadasi fasting day*) and (need to fast till noon for some event)

then write ' Today: Fast till noon for ... Feast is tomorrow.'

If (yesterday is Ekadasi fasting day) and (today is need for fast till noon)

then write ' Today: ...event.... (Fasting was done yesterday). '

This resolution procedure will be performed for each festival separately with appropriate text. If there are two festivals in one day (like sometimes Nityananda and Varaha after Trisprisa Mahadvadasi, or Bhaktivinoda and Vamana after Trisprisa Mahadvadasi), for each festival is writen separate note.

1.8 Calculation of sankrantis

Sankranti is calculated for given day and note about sankranti is placed to parcticular day according one of four systems:

midnight – midnight
sunrise – sunrise
noon – noon
sunset – sunset

Default setting is "noon to noon".

1) for given day we calculate particular value (of noon or sunset or etc..)

1.9 Calculation of events depending on sankrantis

This is a list of events which depends on sankranti day.

Event	Offset	Sankranti
Ganga Sagara Mela	on day of	Makara Sankranti
Tulasi Jala Dan begins	on day of	Mesha Sankranti
Tulasi Jala Dan ends	a day before	Vrsabha Sankranti

1.10 Calculation of exact time for ksaya tithis

If yesterday is the same tithi as today

then today is marked as second day of vriddhi

If today is more than next tithi of yesterday (one tithi is missing)

then ksaya times are calculated

1.11 Correction of calculated times according DST

Finaly are corrected time values calculated. This is valid for these values:
1) Time of Ekadasi Parana
2) Sunrise, Sunset, Noon, Arunodaya
3) Moonrise, Moonset

Document History

Date	Changes
May 8, 2008	Initial release
May 28, 2008	Modified "Calculation of Dvadasi day", "Ekadasi Parana calculation", "Sankranti calculation", "Ratha yatra calculation", "Janmasthami", "Gaura Purnima", "Resolution of fasting days",
June 5, 2008	Corrected "Pusya" to "Pusyami"