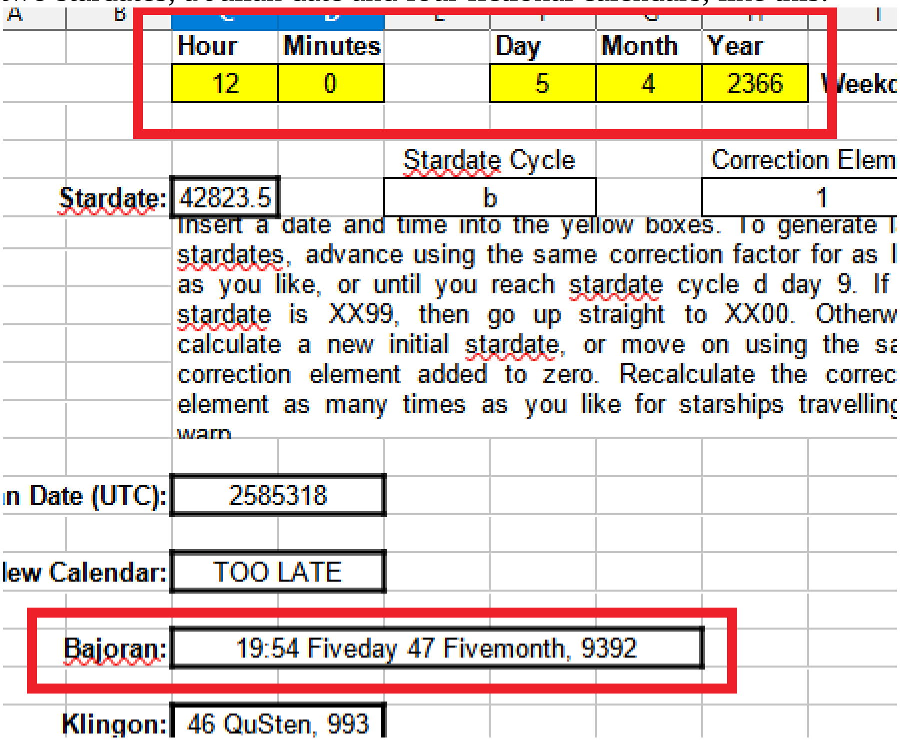
How the Spreadsheet Works

"As well as possible" is the hope. In practice, you fill in a time and date in the yellow boxes with the day in cell $Dates.F2, the month in $Dates.G2 and the year in $Dates.H2. This date is then converted into two stardates, a Julian date and four fictional calendars, like this:

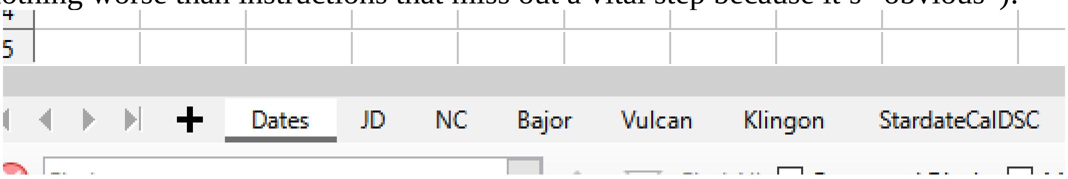


I'll concentrate on the Bajoran date in cell $Dates.C17:G17. All of the calendar conversions are done in pretty much the same way, and the calculation sheets are very similar. The Bajoran calendar is by far the most complicated (the Gratitude Festivals!) so if I can guide you through that one, any of the others will be a doddle. I hope that with using a specific example date, your copy of the spreadsheet will look like mine, so things are clearer still.

Step One: Julian Date

Spreadsheets have a lot of handy "date" functions built in. I found that limiting, especially when I wanted to calculate dates far into the past, and well into the future. In the end, I decided to ignore all the built-in functions, and manipulate the dates myself.

Down at the bottom of the spreadsheet, there are a row of tabs (of course you know about them, but there's nothing worse than instructions that miss out a vital step because it's "obvious"):



The illustration shows how it appears in my version of Libreoffice Calc, when I'm on the top "Dates" page. If you click on the "JD", then you'll move onto that page of the spreadsheet. This page has two functions. It converts the input "standard" date into a Julian day, and also creates what I call an "official" stardate.

First of all, earlier versions of this spreadsheet were made to look "nicer" by hiding the horrible mess of the calculations. So before you go any further, highlight all of the columns from A to at least P, and all the rows from 1 to at least 33. Once that box of cells is selected, click on the "text colour” button at the top of the spreadsheet, and select “Automatic”. This should make all of the “white on white” cells have black text again, and you’ll be able to see everything easily.

I won’t go through the whole thing in detail, since I’ll be doing that for the Bajoran calendar sheet, and it would be a pity if you never got that far, owing to boredom. What this page does is work out exactly how many days have elapsed since 1st January, 1 C.E., and then adds that number to the Julian date for that day. It also works out what day of the week it will be, too. And it weeds out “impossible” dates and times. The Julian date that appears in the relevant box on the “Dates” page is in cell $JD.J24. That cell also provides the starting point for the calculations on all of the other calendar sheets.

Step Two: My Bajoran Calendar

Now click on the “Bajor” tab to bring up that sheet. I’ve checked, and I don’t think there’s anything still hidden on this sheet. Although you’re welcome to test that. It is one of the bigger sheets, so you’ll need to scroll down to see the whole thing. Cell $Bajor.A1 is the raw Julian date, and cells $Bajor.L1 to $Bajor.L3, along with cell $Bajor.P1 are the basics of my version of the Bajoran calendar. The initial calculations are in column A, so I’ll start by following that down. Cell $Bajor.L3 is the Julian date converted into Bajoran days, by multiplying by 24 to get hours, and dividing by cell $Bajor.L1, which has the length of the day in hours. Cell $Bajor.A4 is a fixed number, that took quite a bit of calculation. It’s the number of Bajoran days that have already elapsed by the time of the first Julian day. A shorter era (like the Klingon) would work the other way around, with a number that has to be subtracted from the Julian day. Adding the numbers in cells A3 and A4 together gives the total number of Bajoran days since the Bajoran era started, shown in cell $Bajor.A5. Cells A6 and A7 divide the Bajoran days into the Bajoran year, and then round it to a single year, with no decimal fraction. (I have to confess that I cheated slightly here, and made the Bajoran year last an exact number of Bajoran days. That would be extremely unlikely in “real life,” but the calendar was complicated enough already.)

Once I have a year calculated, there are three very similar calculations underneath. The key element to them are the numbers in cells $Bajor.A9, A19 and A29. Basically, as well as calculating the date in the year I’ve worked out, I also do the same calculation for the year before and the year after. A lot of the time, it has no significance, but where there are leap years, especially if the years vary significantly in length, these calculations are essential.

9392			
2348	2348	0	1
1174	1174	0	1
			2
9391	2347.75	1173.88	
7044	2347	1173	
2E+06	432032	321402	
		3E+06	
		265.766	

Let’s concentrate on the first group of calculations, for Bajoran year 9392 (Cells A9:D17 on the spreadsheet). The calculations for 9391 and 9393 are the same, only the year changes.
The first group of lines (A10:D12) calculate leap years.

9392			
2348	2348	0	1
1174	1174	0	1
			2
9391	2347.75	1173.88	
7044	2347	1173	
2E+06	432032	321402	
		3E+06	
		265.766	

I have them every 4 and 8 years in my calendar, but it'll work for any number. Cell $Bajor.A10 divides the year by how often a leap year comes up. B10 then rounds the first answer down to just the year. Subtracting the result in B10 from the A10 (which is what happens in C10) tells you if the year is exactly divisible, in this case by 4. Cell D10 converts that result into a straight "yes or no" as to whether the year is exactly divisible by returning a "1" if cell C10 contains a zero, and "0" if there's anything else there. Cells A20:D20 show what happens when it isn't a leap year.

19	9391			
20	2347.75	2347	0.75	0
21	1173.88	1173	0.875	0

Cell $Bajor.D12 is the sum of D10:D11. In this case, a value of 0, 1 or 2 is all I need to identify leap years correctly. Changing the values returned (say "10" instead of "1" in cell D11) would let you be more certain of which number(s) the year is divisible by.

13	9391	2347.75	1173.88
14	7044	2347	1173
15	2E+06	432032	321402
16			3E+06
17			265.766

Cells A13:C17 are used to calculate how many days into the year it is. A13 subtracts one from the year, since we only want the number of days up to the end of the previous year. The other cells then calculate the number of Bajoran days, accounting for leap years. The total is in cell C16, and C17 is the number of days left when the number in C16 is subtracted from the one in cell A5.

At this point, there are three numbers, the one in C17 (265.766), the one in cell C27 (574.766) and the one in cell C37 (-8.234). It's easy to see which is the right one, but I need to make the spreadsheet pick it. That's what cells G34:I42 do.

Year	Score	Days
9391	0	574.766
9392	2	265.766
9393	0	-8.234
9392	2	265.766
9392	2	265.766
		265.766

This bit's more organised than usual. You can see I've arranged the years in order. I've then used a simple pair of commands (=IF(I37>0,I37,I36), followed by =IF(I40>0,I40,I35)) to select the smallest of the values greater than zero, since they're always going to be in ascending order by year.

Now we need to start matching that number up to a specific date in the year. That part is handled by cells G6:U21.

								265.766					
	L	N	S	S	N	L	S	N	L		S	N	L
Leapone	1	1			35	35		265.766	265.766			1	1
Onemon	2	2	1	55	55	55	265.766	230.766	230.766		1	1	1
Twomon	3	3	2	55	55	55	210.766	175.766	175.766		1	1	1
Threem	4	4	3	54	54	54	155.766	120.766	120.766		1	1	1
Fourmo	5	5	4	55	55	55	101.766	66.766	66.766		1	1	1
Fivemo	6	6	5	55	55	55	46.766	11.766	11.766		1	1	1
Leapfive	7	7	6			59	-8.234	-43.234	-43.234		0	0	0
									0				0
				274	309	368					5	6	6
											5	6	6

There are some blank lines (H15:U18) which come from an earlier version of the spreadsheet, where the Bajoran calendar had more months in it. Instead of trying to select for one of the three possible lengths of the year (S=”short”, N=”normal” and L=”long”) beforehand, it’s easier to work out all three options together, and then pick the correct one from them. The spreadsheet does it by subtracting the number of days in each month for the year. The last three columns (S7:U14) have a “1” if the number of days is more than zero, and a “0” if it’s less than zero. These columns are added together, giving the numbers in cells S21:U21. Then I get to use one of the handier spreadsheet functions, LOOKUP. Cell N23 has the command =LOOKUP(S21,K9:K18,H9:H18). If you follow that through, the cell looks to see what’s in cell S21, then it matches that number to the ones in cells K9:K18 and displays the contents of the cell in the same row, but in cells H9:H18. The end result is that I have the right “month” name in the cell. It is tremendously useful, but it sometimes doesn’t work that well if you try to “LOOKUP” something that’s already been selected that way.

	0	
	0	
	46.766	
	46.766	
Day	46	47
	19.9164	
Hour	19	
	54.9867	
	54	
	54	
Time	19:54	

And that’s the explanation for what happens in cells H44:H47. Those cells are the start of the process for defining the day of the month, and the time of day. That’s what cells G44:I56 do. Cell I48 has the day of the month, and I’ve made the assumption that the month starts on day 1, not day 0 (although nothing is certain in an alien calendar). The lower cells G49:H54 take the decimal fraction of the day and convert it into a Bajoran “26 hour” time. Again, it was easiest for me to divide “Bajoran hours” into 60 “Bajoran minutes”, but changing cell H51 (=(H49-H50)*60) so that the “60” is your preferred number of subdivisions is all you need to do. The same will work for the number of “hours” in cell H49. These figures are rounded in cells H48 (day), H50 (hour) and H52 (minutes). I’ve used “ROUNDDOWN”, to make sure the numbers don’t jump up if it’s after midday. Cell H56 uses another handy command, =H50&":"&H54 to combine the contents of two cells into one, *and* put a colon between them.

I’ve now just about finished, but I also need to provide a day of the week. My Bajoran calendar ended up with seven days in a week, so I could just repurpose the calculator I’d made for calculating the day of the week from the Julian day. It’s cells $Bajor.B59:G66:

3E+06				0	Oneday
3E+06				1	Twoday
418614				2	Threeday
418613				3	Fourday
3E+06				4	Fiveday
4				5	Sixday
				6	Sevenday
Fiveday					

The number of days in the week can be changed by dividing the total number of Bajoran days (from cell A5) by a different number. Equally, the days of the week can be adjusted to come out correctly by “tweaking” the “LOOKUP” table. Here’s the one from the Julian dates “JD” page in cells $JD.M6:N12 as a comparison:

0	Monday
1	Tuesday
2	Wednesday
3	Thursday
4	Friday
5	Saturday
6	Sunday

Now all the parts of the date are ready. All that remains is to assemble them into a date. That’s cells I27:M28:

Weekda	Time	Day	Month	Year
Fiveday	19:54	47	ivemon	9392

The day of the week is taken from cell B66, the time from H56, the day of the month is from cell I48, the month comes from cell D53 and the year is from cell G41. I’ve then used the spreadsheet command “=J28&" "&I28&" "&K28&" "&L28&", "&M28” to combine the whole thing into a single string in cells L35:P35. It’s the contents of these cells that appears on the top “Dates” sheet as the Bajoran calendar date. The reason I’ve combined everything is to make it easier to cut and paste the date from the spreadsheet into my timeline.

Quick Reference: What Do I Need to Change?

Any calendar, real or imagined, is going to have certain features. A planet will take a certain amount of time to travel once around its sun, giving the year, and the planet itself will rotate, providing a day. The year may well be divided into shorter periods, perhaps, like our months, based on the time it takes a satellite like the Moon to travel once around the planet. Almost certainly, the day will be divided into convenient shorter periods, although there’s no need for them to be anything like our hours, minutes and seconds.

Once you’ve picked (or derived from whatever evidence there is) a length of year and a day,, you can add them to the spreadsheet. The day (in Earth hours) can go in cell $Bajor.L1. The number of “local” days that constitute a year can go in cell $Bajor.L2. My years contained an exact number of days, but yours might not. A simple “Earth year” calculator would have 365.25 days in a year, whilst something more elaborate would have 365.2425 days in the year, to accommodate leap years. My advice is to adjust the lengths of the days and the year to keep things simple. Having a leap year every so often is simple. Having a whole series of different cycles gets complicated very quickly, and makes it more likely that the spreadsheet won’t work. If all else fails, just stick in enough days to balance things out on a regular cycle and say that's how leap day adjustments are handled in your calendar.

Once you have the number of days in your year sorted out, and a system of "leap" adjustments, you can adapt the sections that calculate the leap years, and the total number of elapsed days (cells A9:D37) with the numbers you've worked out. (I'd suggest playing around with a single leap adjustment to start. Once you see how that's working, you can consider more, although the more complex it gets, the less likely the spreadsheet will be to work, based on my own experience.)

Dividing your years into months isn't mandatory, and the number of months in the year isn't fixed. To be really useful, the months should all be about the same length (that's where my Bajoran calendar fails, massively). Unless you're really lucky, your year is unlikely to divide exactly into a suitable number of months, all of exactly the same length. You can adjust them, until you get something that works. The month names go in column H, starting in cell H8. The number of days in each month go in cells L8:N19. Cells L20:N20 give the total number of days in the year, so you can make sure it's right.

If you're going down to the details of what time of day it is, you'll need to change the number in cell H49 from "26" to the number of "hours" you've picked. The same with the "minutes" in cell H51. You may find it handy to just use 24 hours and sixty minutes. That'll give you an idea of what time of day it is in a familiar way.

The weeks (if you have them at all; the Romans didn't bother) need you to choose how many days they last and then change the number in cells B61 and B63 to suit. You'll also need to change the "lookup" table in cells F59:G65, and make sure the formula in cell B66 is adjusted so that it's looking at the right cells.

Oddly, the final step, rather than the first, is to align your calendar with ours. I'll assume that there are at least some occasions when you know the date in your calendar and the "Earth-date" for the same day. It's a case of trial-and-error adjustment of the number in cell A4 until the spreadsheet returns the dates you want it to.

My own experience is that you then have to go back, and try to find out why it's not working yet. I hope these notes might let you avoid that, but also that they will help you when you are.

Timon Proctor,
26 July 2021.