

PROGRAM DESCRIPTION I

Program Title New Moon and Full Moon Day of Month (Improved)
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Program Description, Equations, Variables This program can be used to find the day and time (in GMT) for new moon or full moon, given any month between 1AD and 2500 (at least) AD. It must be stressed that this program uses any approximation of linear extrapolation (see page 7), so although a resolution of 1 hour is given in the result, the typical accuracy is about 6-12 hours. By taking two hundred random dates between 1 and 2500 AD, it is observed that 80% of the results are within ± 12 hours of actual time (using the formulas in reference ③), and no result is more than 16 hours off.

Necessary Accessories None

Operating Limits and Warnings This program is not tested beyond the range of 1AD to 2500 AD. However, the change over from Julian to Gregorian Calendar (skips Oct 5 to 14, 1582) has been taken care of.

- Reference(s)**
- ① "Astronomical Almanac 1982", Central Weather Bureau of R.O.C.
 - ② "PPC ROM User's Manual", Personal Programming Center, 1981.
 - ③ "HP-41 Solar/Lunar Eclipses", David Bartholomew (3666), PPCCJ V9N4 P78.
 - ④ "New Moon and Full moon Day of Month" (#00009C) Users' Library

This program has been verified only with respect to the numerical example given in Program Description II. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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PROGRAM DESCRIPTION II

Sample Problem (Sketch if Desired)

1. To find the new moon day for August 1979

Remark: "new moon day" actually means the day when there is completely no moon.

2. To find the full moon day for Nov 1982

SOLUTION:

Input	Function	Display	Comments
N 8.1979	XEQ "MOON" R/S R/S	N OR F MOON? MM.YYYY? 21:00 8.22.1979	Specify new or full moon Specify date (month & year) Result: 2100 hour GMT Aug 22, 1979 (The actual time is 1719 hour)
F 11.1982	XEQ "MOON" R/S R/S	N OR F MOON? MM.YYYY? 9:00 11.1.1982	(The actual time is 2057 hour)

USER INSTRUCTIONS

SIZE:
(HP-41C) 000

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1.	Load in the program			
2.	Execute the program		XEQ "MOON"	N OR F MOON?
	{ For New moon, key in "N" { For Full moon, key in "F"	N F	R/S	MM.YYYY?
	Enter date in the format:	date	R/S	(Result)
	<u>MM.YYYY</u> month Year (4 digits)			
	Result is in the format:			
	<u>HH:00</u> <u>MM.DD.YYYY</u> Time in Date GMT hour			
3.	For a new case, goto step 2			

PROGRAM LISTING

□ 67 □ 97 ☒ 41C

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
01	LBL	"MOO		48	RCL Y		(First day of month) Day #
N"				49	-		
02	"N OR F			50	14.79		
MOON?"				51	FC? 00		New moon?
03	AON			52	CLX		
04	PROMPT		"N" = New Moon	53	+		
05	AOFF		"F" = Full Moon	54	X<0?		After Oct 5, 1582?
06	ASTO X			55	GTO 00		
07	"F"			56	10		
08	ASTO Y			57	-		
09	CF 00			58	LBL 00		
10	X=Y?		Character = "F"?	59	29.53059		Period of lunar month
11	SF 00			60	MOD		
12	"MM.YYYY			61	+		New Day #
?"				62	ENTER↑		
13	PROMPT		Input Date	63	FRC		
14	INT		(Month, Year)	64	24		
15	LASTX			65	*		hour @ - 23
16	FRC			66	INT		
17	1 E4		Year	67	FIX 0		
18	*		Day # 1 of month	68	CF 29		
19	1		Month	69	CLA		
20	RCL Z			70	ARCL X		Time in GMT
21	2.85			71	"F:00 "		
22	-			72	X<>Y		
23	12			73	INT		
24	/			74	4.2		
25	R↑			75	-		
26	+			76	RCL X		
27	ENTER↑		Compute Julian Day #	77	36524.25		
28	INT		-1721115 from	78	/		
29	ST- Z		calendar date	79	INT		
30	X<>Y		(adopted from PPC	80	ST+ Y		Compute calendar
31	367		ROM routine "CJ")	81	4		date (Y/M/D)
32	*			82	/		from Julian Day #
33	INT			83	INT		-1721115
34	ST+ Z			84	-		
35	SIGN			85	STO Y		
36	%			86	365.25		
37	INT			87	ST/ Y		
38	.75			88	X<>Y		(adopted from PPC
39	ST* Z			89	INT		ROM routine "JC")
40	*			90	ST* Y		
41	RDN			91	RDN		
42	-			92	INT		
43	INT			93	-		
44	R↑			94	.3		
45	-			95	-		
46	INT			96	STO Y		
47	578028.2		Reference day #				

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PROGRAM LISTING

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STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS	STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
97	30.6			51			
98	ST/ Y						
99	X<>Y						
100	INT						
101	*						
102	ST- Y						
103	ISG Y						
104	X<> L						
105	-3			60			
106	X↑2						
107	X<Y?						
108	ISG T						
109	X<> L						
110	-						
111	X<>Y						
112	INT						
113	SF 29						
114	ARCL Y		Month.				
115	ARCL X		Day.	70			
116	CF 29						
117	ARCL Z		Year				
118	AVIEW						
119	END						
(235 bytes)							
30				80			
40				90			
50				00			

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REGISTERS, STATUS, FLAGS, ASSIGNMENTS

DATA REGISTERS	STATUS						
Not Used	SIZE	000	TOT. REG.	34	USER MODE		
	ENG		FIX	0	SCI		
	DEG		RAD		GRAD		
FLAGS							
#	INIT S/C	SET INDICATES		CLEAR INDICATES			
00		Full moon day		New moon day			
29		Show decimal pt		Suppress decimal pt at FIX 0			
ASSIGNMENTS							
FUNCTION		KEY		FUNCTION		KEY	

(CONTINUATION PAGE)

Program Description Cont'd :

The idea behind linear extrapolation is such :-

An average lunar month is 29 day 12 hrs 44 min 2.8 sec (or 29.53058868 solar day). If a "reference" day is chosen where the moon is full, then all other full moon day must differ from this day by integer multiples of one lunar month. i.e.

If $JD\#(\text{Day } X) - JD\#(\text{Ref. Day}) = k * 29.53058868$, then Day X is a full moon day.
 ($JD\# = \text{Julian Calendar Day \#}$)
 $k = \text{integer}$

First, the average new/full moon day and time of 1982 was obtained from astronomical table. For any input month & year, the Julian Day # of the first day of that month is calculated. By using MOD function, the nearest new/full moon day# in the future can be found, then this day # is converted back to month/day/year for output.

Since the periods of ^{the} moon are not constant within a year, errors are introduced. By comparing the results by this program and the results from reference (3) for 200 dates, we see the following:

Error	% of total
$ E < 6$ hours	36
$6 \leq E < 12$ hours	44
$12 \leq E < 14$ hours	16
$14 \leq E < 16$ hour	4
	100

Mean = -0.006 Day
 S.Dev = 0.351

ROW 1 (1 : 2)



ROW 2 (2 : 6)



ROW 3 (7 : 12)



ROW 4 (12 : 18)



ROW 5 (19 : 26)



ROW 6 (27 : 35)



ROW 7 (36 : 45)



ROW 8 (46 : 49)



ROW 9 (50 : 56)



ROW 10 (56 : 61)



ROW 11 (62 : 70)



ROW 12 (71 : 76)



ROW 13 (76 : 80)



ROW 14 (81 : 87)



ROW 15 (87 : 96)



ROW 16 (97 : 103)



ROW 17 (104 : 112)



ROW 18 (113 : 119)



ROW 19 (119 : 119)



