QUIZ - How Well Do You Know RPN?

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Introduction

The most distinctive feature of HP calculators is the use (on many models) of RPN[(1)]. Since HP RPN is older (40 years) than many current HP people it is understandable that RPN has evolved with subtle changes. These changes have been previously documented, explained, and defined in ***HP Solve*** issue #27, page 42 in an article titled HP RPN Evolves. This article differentiated RPN as either classical RPN or ENTRY RPN.

Today HP more broadly defines RPN based on the general post fix logic used for problem solving rather than as an automatic stack based on specific rules[(2)]. How well do you know (classical) RPN? Take the following quiz and then get your rating at the end of this column. It will be fun and I promise that you will learn something. Each question is worth one point.

The Quiz

Do not refer to any references other than a piece of blank paper, a pen, and your favorite Classical RPN calculator. Each answer is worth one point. The five classical RPN commands are: ENTER, ↑; X⇄Y; R↓; LAST X; and R↑.

1. The value of the Golden ratio is: $\frac{1 \pm \sqrt{5}}{2}$. The pressed keys to calculate the positive value are: 1, ENTER, 5, $\sqrt{X}$, +, 2, ÷ is 7 ks. For a very easy point write a sequence that saves one keystroke.

ANS: _____

2. Two Resistors (R_1 & R_2) connected in parallel have a total equivalent resistance, R_T, as follows.

$$R_T = \frac{R_1 R_2}{R_1 + R_2}$$

Assuming that R_1 & R_2 are on the stack, how many keystrokes, ks, are required to obtain a solution?

A – 9 ks, **B** – 8 ks, **C** – 7 ks, **D** – 6 ks, **E** – 5 ks. ANS: _____

3. Using a stack diagram as shown below write the keystrokes and stack register contents for your answer in question #2.

ANS:

Step		1	2	3	4	5	6	7	8	9
T	~									
Z	~									
Y	R_2									
X	R_1									
Press	Start									

~ is don't care.

4. How many keystrokes are required to reverse the order of the stack as shown below?

T	D		A
Z	C		B
Y	B	⇒	C
X	A		D
	Start		End

The shift key of any shifted functions on your favorite RPN machine need not be counted[(3)].

A – 7 ks, **B** – 6 ks, **C** – 5 ks, **D** – 4 ks, **E** – 3 ks. ANS: _____

5. Using a stack diagram as shown below write the keystrokes and stack register contents for your answer in question #4.

ANS:

Step		1	2	3	4	5	6	7
T	4							
Z	3							
Y	2							
X	1							
Press	Start							

~ is don't care.

6. There are two methods (not including data register usage) of using a constant in RPN. The first is replication of the T register. What is the second? ANS: _____

7. Is converting a classical RPN program to an ENTRY RPN program easy and always works?

True or False ANS: _____

8. How may you terminate an entry without pressing a function key? ANS: _____

9. An event counter may be accomplished by storing 1's on the stack and using the T register replication feature to add 1 to the X register each time the + key is pressed. What other technique may be used to accomplish the same thing – pressing a key and incrementing a counter? Programming is not allowed. ANS: _____

10. Which operator typically does NOT alter the LAST X register?
A. +, **B**. -, **C**., 1/X, **D**. x, **E**. ÷, **F**. none. ANS: _____

Bonus Question

11. Solve the Mach Equation. $$M = \sqrt{5\left[\left(\left\{\left[\left(1+0.2\left[\frac{350}{661.5}\right]^2\right)^{3.5}-1\right]\left[1-(6.875\times10^{-6})\,25{,}500\right]^{-5.2656}\right\}+1\right)^{0.286}-1\right]}$$

ANS: _____

The answers are after the three notes.

Notes: Quiz - How Well Do You Know RPN?

(1) RPN is an acronym for Reverse Polish Notation. Any name beginning with Reverse starts out with a negative image for first time encounters with users. The name is so sensitive that users have been debating about it for decades. A presentation by Wlodek Mier-Jedrzejowicz at HHC 2012 even explored RPN using a chapter titled "Really Pathetic Notation" from the book RCL 20. See the HHC 2012 Report in ***HP Solve*** *issue # 29 page 11 titled Hewlett-Packard Handheld Conference #39. Note (10) is reproduced below.*

(10) The book is RCL 20.which may be found at: http://www.limov.com/rcl20/

Bill Wickes' article may be found on page 105.

Many (22) of the HPUC leaders contributed To this book.

RCL 20: People, Dreams & HP Calculators
W.A.C. Mier-Jedrzejowicz Ph.D. & Frank Wales (Eds)
2002
ISBN: 0-9510733-3-8

Fig. 13 – RCL 20 book records the people history of HPCC.

Here is a video link to Wlodek's presentation. http://www.youtube.com/watch?v=qRrAj-GCTQM

(2) A test for the type of RPN an HP machine uses is quoted from the ***HP Solve*** *article. "There are two basic forms of HP RPN. Classical RPN and Entry RPN. While they are very similar overall in that they are both a postscript user interface there are subtle differences, a few of which are described."*

"An example of a current model Entry RPN machine is the HP 30b. If you place the machine in RPN mode, and have a clear stack, you may compare the stack operation with a Classical RPN machine such as the HP 15C. Press 5, ENTER. Next press x. On the 30b you will see 0 because the Y register is zero and 0 x 5 = 0. On the 15C you will see 25 because the ENTER, ↑, raised the stack as shown in the three cases above."

See the article in the issue at the link below. Table 1 lists of all of HP's calculators as to which RPN they use. Also see Note 2.

http://h20331.www2.hp.com/hpsub/downloads/HP_Calculator_eNL_04_April_2012%20(2).pdf

(3). For a table (by Jake Schwartz) of HP calculator stack commands and the keystrokes required to execute them see Table 1 (page 5 of 7) in ***HP Solve*** *issue #4 of the article titled Introduction to RPN Tips V5.*

See the Answers on the next page. Count your points and look up your number in Table 1 at the end.

Answers: RPN Quiz - How Well Do You Know RPN?

Q 1. By changing the order of the operations the ENTER may be eliminated. 5, $\sqrt{X}$, 1, +, 2, ÷ is **6 ks**.

Q 2 & 3. Q #2: Take one point if you answered B, or E.
Q #3: Take one point if your stack diagram matches one of the three below.

8 ks solution Uses stack replication and Last X.

Step		1	2	3	4	5	6	7	8
T	~	~	R_1	R_2	R_2	R_2	R_2	R_2	R_2
Z	~	R_1	R_2	R_2	R_2	R_2	$R_{1x}R_2$	R_2	R_2
Y	R_1	R_2	R_2	R_2	R_2	$R_{1x}R_2$	R_2	$R_{1x}R_2$	R_2
X	R_2	R_2	R_2	R_1	$R_{1x}R_2$	R_2	R_1	$R_{2+}R_1$	$\frac{R_1R_2}{R_1+R_2}$
Press	Start	↑	↑	R↑	x	X⇄Y	LASTX	+	÷

~ is don't care.

8 ks solution Uses Last X only.

Step		1	2	3	4	5	6	7	8
T	~	~	R_2	R_2	R_2	R_2	~	~	~
Z	~	R_1	~	~	R_2	~	$R_{1x}R_2$	~	~
Y	R_1	R_2	R_1	R_2	~	$R_{1x}R_2$	R_2	$R_{1x}R_2$	~
X	R_2	R_2	R_2	R_1	$R_{1x}R_2$	R_2	R_1	$R_{2+}R_1$	$\frac{R_1R_2}{R_1+R_2}$
Press	Start	↑	R↓	X⇄Y	X	R↑	LASTX	+	÷

~ is don't care.

5 ks solution Uses alternate algebraic form of the equation:

$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

Step		1	2	3	4	5
T	~	~	~	~	~	~
Z	~	~	~	~	~	~
Y	R_1	R_1	$1/R_2$	$1/R_2$	~	~
X	R_2	$1/R_2$	R_1	$1/R_1$	$1/R_2+1/R_1$	$1/(1/R_2+1/R_1)$
Press	Start	1/X	X⇄Y	1/X	+	1/X

~ is don't care.

Is there a minor accuracy caution that should be considered with this solution?

Q 4 & 5. Q #4: Take one point if you answered D.
Q #5: Take one point if your stack diagram matches one of the two below

4 ks solution Uses Roll Down, R↓ (primary operator on most RPN machines)

Step			1	2	3	4
	T	4	4	2	1	1
	Z	3	3	4	2	2
	Y	2	1	3	4	3
	X	1	2	1	3	4
Press		Start	X⇄Y	R↓	R↓	X⇄Y

4 ks solution Uses Roll Up, R↑ (often not found or is a shifted operator on most RPN machines)

Step			1	2	3	4
	T	4	4	3	1	1
	Z	3	3	1	2	2
	Y	2	1	2	4	3
	X	1	2	4	3	4
Press		Start	X⇄Y	R↑	R↑	X⇄Y

Q 6. By using the LAST X register. An example is a currency or other conversion factor. The Z and T registers are retained after multiple uses of the conversion calculation. See ***HP Solve*** RPN Tip # 12 in issue 12.

Q 7. False. An extra ENTER may be required for many stack operations for more modern machines using ENTRY RPN.

Q 8. By pressing X⇄Y twice.

Q 9. By using the statistical function Σ+ key. The number of data entries is tallied and this may be used as an event counter. See ***HP Solve*** RPN tip # 11 in issue 11.

Q 10. F. Test by filling the stack with zero and pressing + to store zero in LAST X. Perform each operation followed by LAST X.

Q 11. This is a classical calculator problem that has appeared in many manuals for the earlier HP RPN machines and it provides a good test of user RPN skill. For a complete discussion of all aspects of solving this equation see an article titled HP Algebraic by Palmer Hanson in ***HP Solve*** Issue #22 pages 12 - 15**. If you got 0.835724536 take one point**. You probably pressed 61 or more keys - 62 keys on an HP 35s.

How many points did you get? Include the bonus point if you answered # 11. Determine your rating from the table below.

Table 1 – Points vs. Skill/title

Points	Skill/title
11 or 10	RPN author, Super user
9 or 8	Expert
7 or 6	Average user

Points	Skill/title
5 or 4	Casual user
≤3	New user
0	History major

If you have been an avid reader/student of ***HP Solve*** you should be an Average user or better.