A User's Comments on Two HP-42S Emulators

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It can be argued what use it would be to emulate the HP-42S. Especially as there have been several more powerful successors in the HP28/48/49 line of calculators. However, there are some important features of the HP-42S that unfortunately were lost in these later calculators. Among these features can be mentioned the keystroke programmability, the numbered registers and the fixed four level stack. All of these represents the end of a long chain of previous developments – with roots in classical RPN calculators such as the HP-67 and the HP-41C(V/X).

The HP-42S is still today, 15 years after its introduction, the most advanced calculator that follows this classic RPN tradition. This might also be an explanation to why the HP-42S regularly sells for more than US$200 on eBay. And in contrary to many other auctions for "collectibles" these calculators are actually bought to be used.

The picture gets even more puzzling if one starts to consider the fact that Hewlett Packard in the early 1990s decided to kill off the branch of calculators representing the HP-67, HP-41C(V/X) and HP-42S by not releasing the planned expanded successor to the HP-42S with the anticipated name HP-42SX.
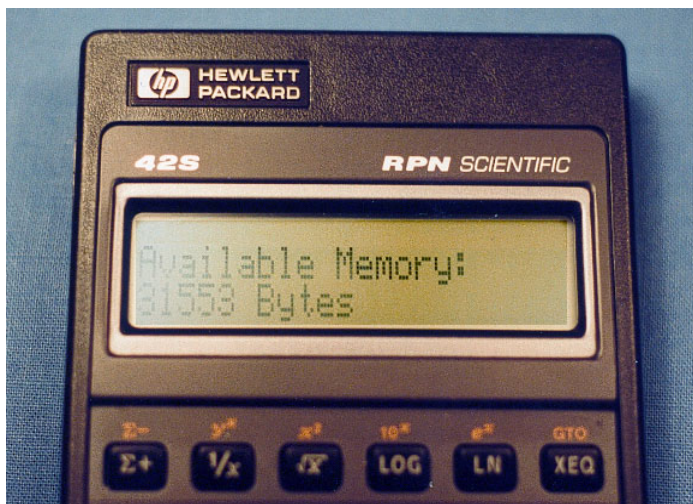

Figure 1. HP-42S upgraded to 32K – 31553 bytes available.

As have been shown by Tony Duell and Paul Brogger the hardware of the HP-42S supports 32K. The only modifications required to upgrade a HP-42S to 32K is to replace the 8K RAM chip with a 32K RAM chip and change two jumper setttings.

Rumours have also been circulating on the internet about test versions of the HP-42S with I/O capability. It is therefore not very unrealistic to assume that the never released HP-42SX could have been equipped with both 32K RAM and serial I/O.

That the I/O capabilites were truly within reach is indicated by the HP-28S with RS232 emulated in software (at 2400 baud) that Christoph Giesselink demonstrated at the HP-Meeting the 20th September 2003 in Allschwil, Switzerland. The HP-42S and the HP-28S are very similar internally. Further, the HP-42S has room for an additional ROM on the circuit board, which can be called

from user code (using the XFCN). This ROM area would be ideal to hold the code for I/O communications.

Two questions therefore naturally comes to mind: Why did Hewlett Packard never release a HP-42SX in the early 1990s? And why did Hewlett Packard, given a second chance, in 2003 decide to give new life to the HP-32SII in the upcoming HP-33S instead of the HP-42S?

These questions might remain unanswered - and instead of sitting waiting in vain let us instead focus on two very welcome and real additions to the world of the HP-42S calculator, the two emulators: Emu42 by Christoph Giesselink and HP-42X by Hrastprogrammer.

While a successful emulation would be useful in itself it also has another important implication. One of the most severe limitations of the HP-42S - the lack of serial I/O - can easily be overcome by the use of emulators. Not surprisingly, both Emu42 and HP-42X provide just the functionality to LOAD/SAVE individual programs (although the full version of Emu42 that supports this has not yet been publically released).

With these emulators it is therefore for the first time possible to build up a library of HP-42S binaries, to create listings from binaries (for an attempt of such a small tool see 42s2html by the author of this article) or even to write a user tool for compilation of source code into binaries (there is for example already a user tool by Leo Duran that does exactly this for the HP-41 and a tool for the HP-42S could use the same principle.).

Even if these emulators can't provide LOAD/SAVE functionality for the real HP-42S – of course, only a true hardware modification would can do this – they can nonetheless simplify the development and testing of RPN programs immensely. Gone is the time consuming process of using the IR printer (or manually writing down a listing by hand) only to have an archived copy of a program before making a small modification to the code.

The usefulness of having two different HP-42S emulators available is added to by the fact that they cover different ground and therefore complement each other. While Emu42 runs under Windows on the PC, HP-42X is actually a calculator emulator running on the HP-48SX/GX (or the HP-49G). The idea of a calculator emulator running on a calculator might seem baroque to some, but it actually makes perfect sense. Entering programs and making smaller tests is much faster on a device with a calculator keyboard. And when the programs are more finished these can in turn be transferred to the PC and run within Emu42 at speeds that are up to a hundred times faster than on the real HP-42S (measured on a 1GHz PC).

The exchange of binaries is simplified by the format between the two emulators being almost the same, only the 13-byte header, i.e."HPHP48…", of a HP-42X file

needs to be removed before it can be loaded into Emu42.

It is likely that the HP-42S enthusiast would have good use of both these emulators. Although running HP-42X inside Emu48 on the PC (which gives the feeling of having an emulated HP-48 running HP-42X) might be more preferable until a full version of Emu42 with the option to LOAD/SAVE individual programs is made publically available (more about this below).
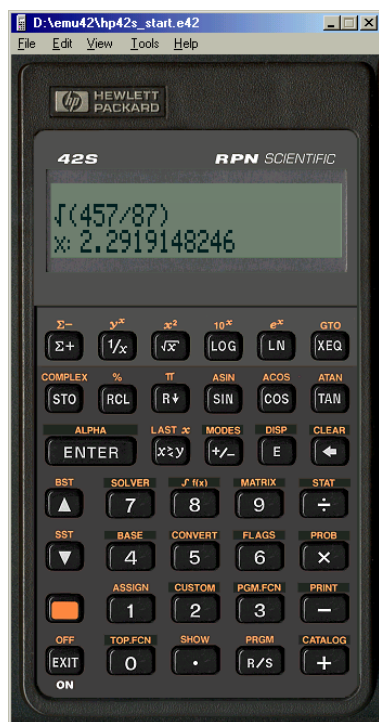

Figure 2. Emu42 (Windows)

Emu42 - A multipurpose Pioneer emulator (Windows 9x/2K/XP + Pocket PC 2002)

The overall goal of Emu42 is perfect emulation of the Pioneer series. Not only the HP-42S but also the HP-17B, HP-17BII and HP-27S (all in the publically available beta version) and the HP-28S and HP-19BII (in the not yet released full version) are emulated.

A characteristic of Emu42 is that it emulates the hardware down to the tiniest detail. As a machine code debugger is also available this makes Emu42 an ideal tool to explore the inner workings of the HP-42S or even for writing and debugging machine code programs for the 42S.

Emu42 is created out of Emu48 and if you have previously used Emu48 you would immediately feel at home with Emu42 as all menus and options are almost identical. Even the possibility to customise the look of the emulated calculator by KML scripts has been carried over to Emu42.

The emulator has a very polished and finished feel to it, is very stable and always behaves as expected. There is actually not much that could be improved in it - it would in that case be the addition of emulation of the beeper and the IR printer. (Although these are features that are in no way central and that are rarely used.)

Due to experiences from Emu48 leading to floods of both not very well informed and in some cases even rude emails Christoph Giesselink has not been keen on repeating that experience with Emu42. As Emu42 has inherited the GNU Public License from Emu48 Christoph has decided to release it under the GPL but instead be very restrictive with making releases publically available.

An early beta version (0.10) is currently available at:
   http://privat.swol.de/ChristophGiesselink/Lewis/Hp42demo.zip

This beta version is almost complete but does not contain the so much longed for LOAD/SAVE functionality for individual programs or support for emulating the HP-28S or the HP-19BII. It does however allow the user to LOAD/SAVE the current state of the calculator, including program memory.

In a posting at the forum at the HPMuseum (www.hpmuseum.com) Christoph Giesselink wrote on the conditions of emulator development in a long posting (on the 14th of December 2003):

> There are (!) fully working emulator versions (Emu42) for the HP42S running on Win32 and PocketPC 2002 with better emulation quality and additional features over the public beta. But here I must criticize the GPL. Emu42 share about 25% of unmodified code with the original Emu48 v1.0 version written by Sebastien Carlier. I have no chance to publish Emu42 and also protect my investments without complete rewriting the sources. I'm not talking about profit here, I'm talking about the costs I had to do this work.
>
> ...
>
> After this experience and the experience other people have about honoring there work, I decided to go the only way the GPL allows me. I use the right to use and modify the GPL sources, but don't publish them, so I don't have to publish the modified sources also!
>
> There are many people out there crying for software, but when we are on the point, they have to pay a little fee for it, we never hear from them again. So what will happen when I publish the sources and binaries of Emu42 on my page and ask for a donation? I don't think that I collect US$ 100, but I know from my experiences with Emu48 that I get many many support request by Email having problems to get the ROM image and so on...
>
> About what prices we are talking about? In spring last year I asked for a complete new high range PocketPC PDA with some extras (to start writing emulators for the PDA) which had a value at this time of about 700 EUR (~ US$ 850 now). That's still the price for publishing my sources (and binaries) of the full versions of Emu42.

It would be an understatement to to say that it would be a great loss if the full version of Emu42 would never be released. The future of RPN calculation would actually look less bright without it.
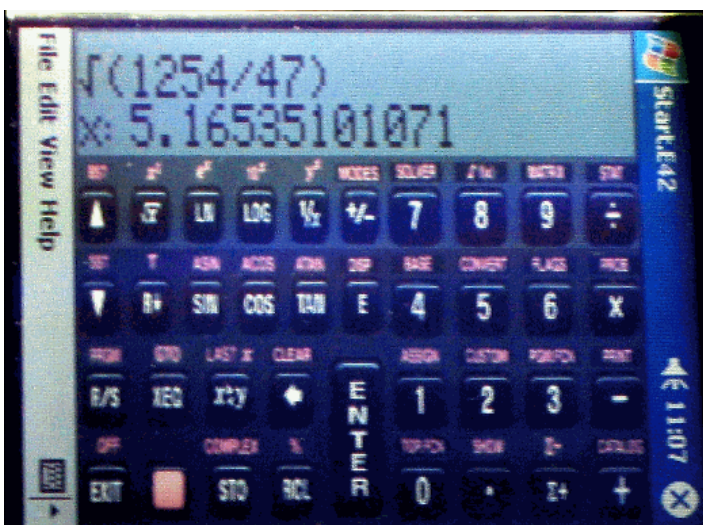
As the careful reader noted Christoph also mentions a Pocket PC 2002 version of Emu42 in his posting. This is a yet unreleased version of Emu42 for the StrongARM SA1110 equipped PDA, e.g. the HP Jornada 560 series.

Figure 3. Emu42 for Pocket PC 2002

As it is based on the same sources as the PC version it behaves very similar to its bigger brother. Added to this

version is also a vertical mode that allows for running it with the screen tilted. This makes it possible to fit a big LCD with a size of 262 x 48 pixels.

A fast emulation core makes Emu42 for Pocket PC 2002 the currently fastest pocket device that runs HP-42S programs. (The speed is roughly five times faster than the real HP-42S, measured on a HP Jornada 568).

My personal hope, both as an author of this article and as a beta tester of Emu42 is that the Emu42 project would be sponsored by donations/lendings of other Pocket PC devices, e.g. Pocket PC 2003 devices, devices with Xscale CPUs and so on, in order to enable Christoph Giesselink to adapt Emu42 to the plethora of different devices of the whole Pocket PC platform. That would be an interesting path into the future.

HP-42X - Emulating the HP-42S on the HP-48SX/GX and HP-49G

Figure 4. HP-42X (HP-48SX/GX,49G)

HP-42X is in contrary to Emu42 a commercial emulator. The price of HP-42X is as of this writing 60 EUR or 75 USD and can be acquired by contacting Hrastprogrammer at: "http://hrastprogrammer.tripod.com"

HP-42X runs on any HP-48SX/GX with at least 256K RAM or on the HP-49G. (There is not yet a version for the HP-49G+.) The description below is based on experiences from the HP-48 version but most comments should apply also to the HP-49G version.

HP-42X installs into one memory port and then uses either port or main memory for the emulated program memory. Although it comes in versions that run on a HP-48GX with only one 128K RAM card (EASY and LITE versions) the recommended setup would be a HP-48SX/GX with two additional 128K RAM cards to run the EXTENDED version.

The EASY version provides 32K available RAM inside the emulated HP-42S while the LITE and EXTENDED versions give a whole 96K RAM. With this amount of RAM it not only possible to store more and larger programs, it is also possible to solve larger problems. (It is for example possible to create matrices of sizes up to 100 x 100.)

Although it could be expected that the emulation could be quite slow on the HP-48SX/GX it is rather surprisingly fast. It is more or less equivalent to the original

HP-42S on a HP-48SX and 1.5 times the original on a HP-48GX. On an overclocked HP-48GX (e.g. with the Cynox double speed upgrade) HP-42X runs at the same speed as a HP-42S in FAST mode.

As the keyboard layout is slightly different between the HP-48GX and the HP-42S it takes a little while to get used to, but is still fairly easy to learn. I soon wrote a small RPN program that uses another feature of HP-42X, IR Printer emulation, to print a small help screen of the most hard to remember keymappings to the upper area of the LCD.

The comments about Emu42 being very polished and having finished feel to it can be repeated here. In the very first releases there were small problems regarding installing HP-42X together with stack replacements such as JAVA, but these problems are since long gone. Hrastprogrammer has also always been very attentive to any problems that might arise.

All in all, the HP-42X represents everything that the HP-42SX that Hewlett Packard never released should have been. It provides both larger program memory than the HP-42S and the possibility to LOAD/SAVE programs as binaries. The binaries are stored on HP-48 as encapsulated strings which can then be transferred to and from the PC using ordinary PC/HP-48 connectivity tools. The only thing you loose compared to the real HP-42S is the small form factor of the HP-42S.

HP-42X can be seen as carrying a relatively high price tag, but using HP-42X is a very rewarding experience to any HP-42S enthusiast. If you would still be in doubt there is a demo version that could be obtained and test run.

Finally, some words of obtaining a ROM dump

Even though the ROMs of the HP-41C and HP-48/49G series are publicly available the ROM of the HP-42S is still covered by copyright. If this is only by chance or if there is a specific reason behind this (e.g. that Hewlett Packard still has not given up the plans for a HP-42SX altogether) is hard to say. Unfortunately, this means that any user that wants to use a HP-42S emulator must go through the process to extract a ROM image from his own HP-42S. (Christoph Giesselink has provided a set of tools that simplify this process by entering a piece of machine code that automatically sends the ROM over the IR to a HP-48 running BINPRT, see: http://privat.swol.de/ChristophGiesselink/Emu28/cpromupl.zip)

One would hope that Hewlett Packard either releases a HP-42SX (or a HP-42S Platinum as it might be called today) or that the copyright of the HP-42S ROM is lifted. Either way that would be a great gift to a user community still convinced of the superiority of the RPN concept and determined to continue to use it for a long time to come.