Fibonacci

The recursive Fibonacci is a benchmark that can be used to compare different implementations of the same language. The most recent effort in implementing Joy is called HET and that gives the starting point of the comparison.

HET

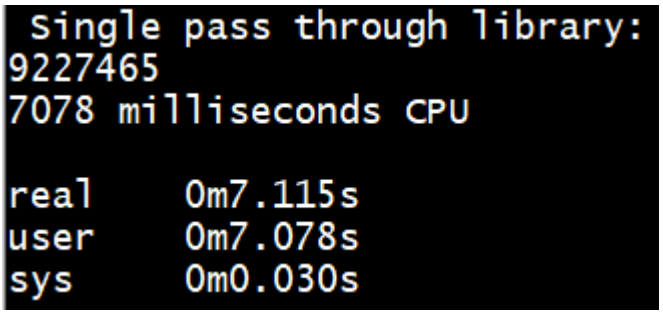
The Fibonacci benchmark measures function call overhead. HET has some overhead, because every time a function is executed, the body of the function gets copied to the program stack. When functions written in C are called, these functions need to be searched in the symbol table. When integers are used, they need to be converted from presentation format to binary format. And all of that needs to be stored in memory that is allocated from the heap. The result of calculating fib(35) is given in this picture:

```
HET  -  compiled at 19:45:47 on Jul 12 2024
9227465

real    1m0.603s
user    1m0.546s
sys     0m0.015s
```

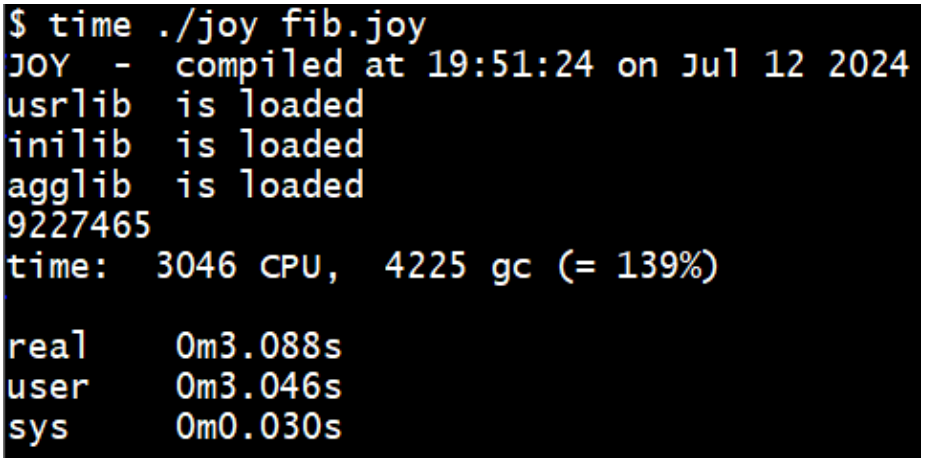
42minjoy

The next candidate for comparison is 42minjoy, because this minimal implementation is quite similar to HET. The body of a function is not copied to a program stack; instead the function `joy` calls itself when evaluating the body of a function. Functions are only searched in the symbol table once, when reading the text of the function; function addresses are used when evaluating a function. Integers are available in binary format. And the garbage collector is used, whenever the memory array has been fully used.



joy0

The super original Joy uses a copying collector that is faster than the mark/scan collector used in 42minjoy.



Legacy

The legacy version is similar to joy0, except that it has more builtins.

```
$ time ./joy fib.joy
usrlib  is loaded
inilib  is loaded
agglib  is loaded
9227465

real    0m3.025s
user    0m2.953s
sys     0m0.061s
```

JOY

The original Joy is similar to Legacy, but uses a flexible array as memory area.

```
$ time build/joy fib.joy
usrlib  is loaded
inilib  is loaded
agglib  is loaded
9227465

real    0m5.823s
user    0m5.562s
sys     0m0.249s
```

joy1

The original Joy linked to the BDW garbage collector.

```
$ time build/joy fib.joy
usrlib  is loaded
inilib  is loaded
agglib  is loaded
9227465

real    0m18.977s
user    0m14.125s
sys     0m4.843s
```

Foy

Foy is a Forth-inspired Joy that uses vectors for stack and code.

```
$ time build/joy fib.joy -w
usrlib  is loaded
inilib  is loaded
agglib  is loaded
9227465

real    0m11.727s
user    0m11.687s
sys     0m0.030s
```

Moy

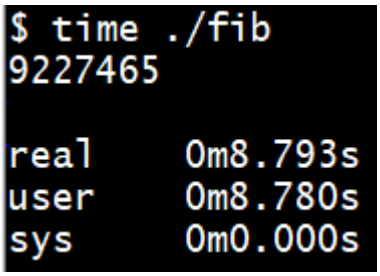
Moy also uses vectors for stack and code. The implementation of those vectors differ from those of Foy.

```
$ time build/joy fib.joy
usrlib  is loaded
inilib  is loaded
agglib  is loaded
9227465

real    0m11.171s
user    0m11.125s
sys     0m0.030s
```

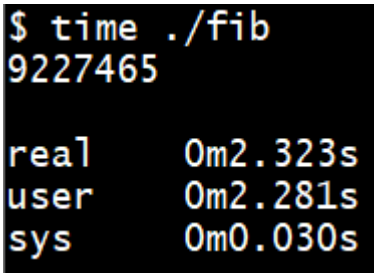
Soy

Soy uses the same code as Moy, compiled to a stand-alone binary.



Roy

Roy uses code that differs from Moy. It allows recursion on the hardware stack.



Source code

HET

```
#define sub     sub $
#define add     add $
#define less    less $

(a % ; b % ; a * b *) swap : ;
#define swap    swap * !

(a % a *) dup : ;
#define dup     dup * !

( () t : ;
  (1 sub dup fib_rec * ! swap 1 sub fib_rec * ! add) f : ;
dup 2 less * !) fib_rec : ;
#define fib_rec fib_rec * !

35 fib_rec .
```

Note that this source must be run through the C preprocessor before it can be executed.

42minjoy

```
fib == dup 2 < [[1 - dup fib swap 1 - fib +] []] index i.

35 fib.
```

The source code comes in two files. The first file is included from 42minjoy.lib

joy0

```
0 __settracegc.
35 [small] [] [pred dup pred] [+] binrec.
```

The `__settracegc` is needed in order to prevent many messages about the garbage collector that would slow the program down.

Legacy, Joy, and joy1

```
35 [small] [] [pred dup pred] [+] binrec.
```

Legacy, Joy, and joy1 do not need `__settracegc`.

Foy, Moy, Soy, and Roy

```
35 [dup small] [] [pred dup pred] [+] binrec.
```

Foy and Moy benefit from using `dup` in the condition; Soy and Roy require it.

Conclusion

HET is slowest, by far, followed by joy1. Roy is fastest, followed by joy0. Even though Roy is compiled, it is not significantly faster than joy0. The reason is that although Roy is compiled, it still uses exeterm, that is the interpeter, to evaluate programs.