

Lab02 A Variant of the Fibonacci Sequence

Task

Do you still remember the Fibonacci sequence of the midterm exam?

Now we expect you to calculate a variant of the Fibonacci sequence:

$$\begin{aligned} F(0) &= F(1) = 1 \\ F(N) &= F(N-2) \% p + F(N-1) \% q \quad (2 \leq N \leq 1024) \\ p &= 2^k \quad (2 \leq k \leq 10), \quad 10 \leq q \leq 1024 \end{aligned}$$

Note that **p** will be stored in **x3100**, **q** will be stored in **x3101** and **N** will be stored in **x3102**.

Your job: store **F(N)** in **x3103**.

R0-R7 are set to zeroes at the beginning and your program should start at x3000.

Here are some examples:

N	p	q	F(N)
100	256	123	146
200	512	456	818
300	1024	789	1219

Score

Correctness for 50% and the report for other 50%.

Submission

Note that from this experiment, each experiment requires using **assembly code**.

Here are some notifications:

- Your program should start with **.ORIG x3000**

- Your program should end with **.END**
- Your last instruction should be **TRAP x25 (HALT)**
- **Capitalized** keywords(also labels) are recommended (For example, use "ADD" instead of "add", use "NUMBER" instead of "number")
- **Spaces** after **commas** (ADD R0, R0, #1 rather than ADD R0,R0,#1)
- **Decimal** constants start with #, **hexadecimal** with lowercase x
- Write **comments** when necessary

You may also refer to the textbook for more details of code style.

Your submission be structured as shown below.

```
PB21*****_Name.zip
├── PB21*****_Name_report.pdf
└── lab2.asm
```

Reports

Your reports should contain at least the five parts below:

- purpose
- principles (e.g. how to deal with modulus)
- procedure (e.g. bugs you encountered and how to solve them)
- results of your test
- answer to the question: How can you improve the efficiency of loop structure in your program? (Just describe your idea briefly.)

Sth Interesting

Here are some questions worth thinking:

You don't have to answer them in your report!

You can answer in your report, but that will bring you no more extra points but feedback from your TA.

Don't worry!

You may find that this fibonacci sequence has periodicity sometimes. For example, when (p,q) is (32, 16), (64, 32), or (32, 64).

1. Can you make a conclusion of the least positive period of these sequences.
2. Can your conclusion apply to all integer p that $4 \leq p \leq 1024$? Prove that or give one counter example.