EE 306: Programming Lab 1

Course Instructor: Prof. Nina Telang
TAs: Aniket Deshmukh, Shruthi Krish

All Lab assignments must be completed individually. You are not permitted to seek help or clarification from anyone other than the instructor or the TAs.

Due date: 3/2, 11:59 PM

Substitution Ciphers

One of the simplest forms of cryptography, substitution ciphers encrypt an input by replacing individual letters. Below are examples for a simple scheme for encrypting a 3-letter word:

- ***L a b*** -> ***M c f***
- ***a t e*** -> ***b v i***

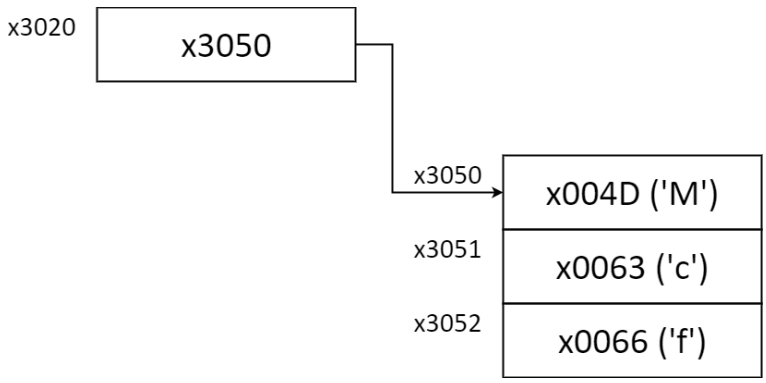
The scheme is as follows:

- Replace the first letter (***L***) with the next ASCII character (***M***)
- Replace the second letter (***a***) with the ASCII character 2 positions ahead (***c***)
- Replace the third letter (***b***) with the ASCII character 4 positions ahead (***f***)

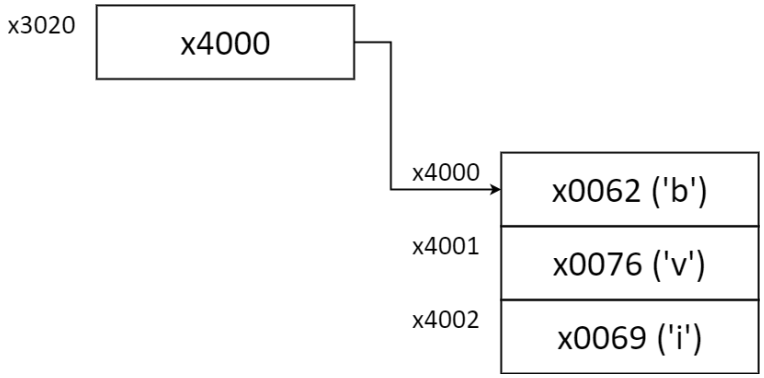
Problem Statement

Your task is to write a program in **LC3 machine code (1s and 0s)** to **decrypt** a 3-letter ASCII word. The ASCII characters are stored at consecutive memory locations starting at an address specified by the value at location x3020. The decrypted result is stored in the same location the input was read from.

e.g. 1: Say the value at address x3020 is x3050. The letters of the word to be decrypted (***'M c f'*** from the above example) are stored at locations x3050, x3051, x3052. Your program should read the contents of the memory, operate upon them, and store the ASCII for letters ***'L a b'*** at x3050, x3051, x3052.



e.g. 2: In this example, the value at address x3020 is x4000, and the word to be decrypted is '***b v i***'. Your program should read the ASCII characters at x4000, x4001, x4002, and eventually store the ASCII for letters *'**a t e**'* at x4000, x4001, x4002.



Points to Note

- The value at x3020 is referred to as a pointer and can be any value between x3030 and x7FFD.
- Letters can consist of any ASCII characters and are stored in the lower 8 bits of the 16-bit memory word.
- No overflow needs to be considered. For example, *'**@ a z**'* when encrypted becomes *'**A c {**'*.
- Hint: Since we do not know the address of the letters directly, a simple LD or ST to read them might not work. What other data movement instructions could help?

Submission Instructions

- The program should be written and compiled using the LC3Edit application.
- The LC3Simulate application can be used to simulate and debug the program.
- The final submission is single file named **lab1.bin** (must be in .bin format), which is to be pushed onto branch 'lab1' of the repository created for you on Github.