

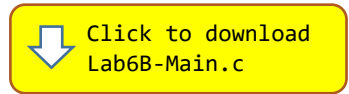
Programming Lab 6B

Recursive Flood Fill

Topics: Compare and branch instructions, recursion in assembly.

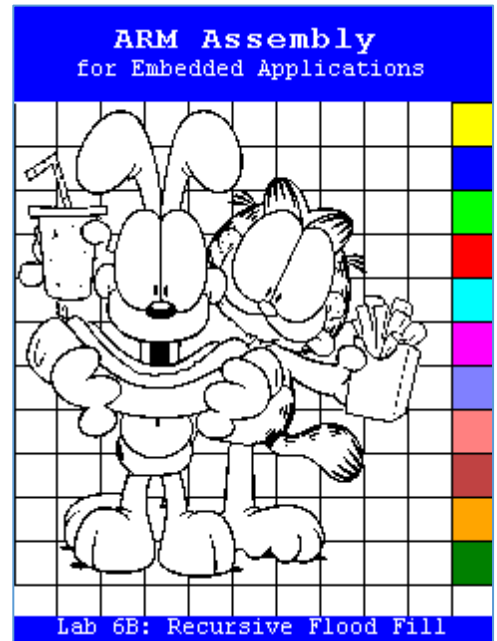
Prerequisite Reading: Chapters 1-6

Revised: June 22, 2021



Background¹: The flood fill algorithm is used to implement the "bucket" fill tool of paint programs to fill connected, similarly-colored areas with a different color. The algorithm takes four parameters - the x and y coordinates of a start position, a target ("old") color, and a replacement ("new") color. The algorithm looks for all pixels in the image that are connected to the start node by a path of the target color and changes them to the replacement color. There are many ways to implement the algorithm, but they all make use of a queue or stack data structure, explicitly or implicitly. Perhaps the easiest to visualize is the 4-way recursive version that is used in this assignment.

Assignment: The C source code of the main program already contains a function called `FloodFill` that is a recursive implementation of the flood fill algorithm. The main program may be compiled and executed without writing any assembly. However, your task is to create a faster version in ARM assembly language. The original C function has been defined as "weak", so that the linker will automatically replace it in the executable image by the one you create in assembly; there is no need to remove the C version.



Download the C main program and locate the `FloodFill` function. Use it to guide the implementation of your assembly language version. `FloodFill` calls two C functions (`OutOfBounds` and `PixelAdrs`) that are provided in the main program, and which must be called by your assembly language version. Your code will likely need to push and pop registers; be sure that the total number of registers you push and pop is even so that the address held in the stack pointer remains a multiple of eight to satisfy the [data alignment requirements](#) of compiled C code.

Test your code using the main program. If your code is correct, the display should initially look like the image shown. Click on the color palette to select a new color and then click on any part of the image to change the color of a region. The blue push button may be used to undo up to the last 100 fills. Errors will display a message in **white text on a red background** and stop the program.

¹ https://en.wikipedia.org/wiki/Flood_fill