Programming Lab #5b
Recursive Flood Fill

Topics: Compare and branch instructions, recursion in assembly.

Prerequisite Reading: Chapters 1-6
Revised: March 22, 2020

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 color, and a replacement 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 in which the flood-fill algorithm can be structured, 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.

Assignment: Create an ARM assembly language source code file containing the assembly language version of the following C function. Functions OutOfBounds and PixelAdrs are provided in the C main program.

```c
void FloodFill(int32_t x, int32_t y, uint32_t old_color, uint32_t new_color)
{
uint32_t *ppxl ;  // Use a register to hold this temporary variable

if (OutOfBounds(x, y)) return ;

ppxl = PixelAdrs(x, y) ;
if (*ppxl!= old_clr) return ;
*ppxl = new_clr ;
FloodFill(x - 1, y, old_clr, new_clr) ;
FloodFill(x + 1, y, old_clr, new_clr) ;
FloodFill(x, y - 1, old_clr, new_clr) ;
FloodFill(x, y + 1, old_clr, new_clr) ;
}
```

Test your code using the main program downloaded from here. If your code is correct, the display should initially look like the image at right. Errors will display a message in white text on a red background and stop the program. 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.

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