The hardware for Lab 15 is essentially a combination of Labs 13 and 14, plus two switches on PE1 and PE0 and two LEDs on PB5 and PB4. Once you have the hardware built, it makes sense to rerun the Lab 13 real board grader and Lab 14 real board grader to make sure the DAC and ADC both still work. The new hardware is the Nokia 5110 display. There are three options

1. If you have a real Nokia, then you can interface it to PA7, PA6, PA5, PA3 and PA2. See the comments in the Nokia5110.c for how to wire it up. Notice there are multiple versions of the display (blue and red). Make sure you are connecting signals by their name on not by pin number.
2. You can of course develop and run the game on the simulator. Since Lab 15 is completely optional, feel free to debug it on the simulator and stop. You will need a screen capture application to create a YouTube video to upload for the competition.
3. There is a version of the Nokia5110.c driver that creates a virtual display. If you choose this option, first debug the game in the simulator, and then when you are ready to switch over to the real board and use the virtual display. All the function calls are the same, so you can use the same **Nokia5110.h** header file. For the virtual display, the graphics commands are streamed out the UART to your PC. Because of optimization, the virtual display actually runs faster than the real display. You must be running TExaSdisplay version 1.08 or higher to use the virtual display. Open the COM port and select the Nokia option to observe the graphics generated by your program. The cool part of this option is games developed on the real Nokia can be played on this virtual Nokia, and games developed on this virtual Nokia can be played on the real Nokia.

LaunchPad	Nokia 5110
PA7 Reset	RST
PA3 SSI0Fss	CE
PA6 Data/Command	DC
PA5 SSI0Tx	Din
PA2 SSI0Clk	Clk
3.3V power	Vcc
not connected	back light BL
Ground	Gnd

If you wish to use the back light, you could connect 3.3V through a 200-470 Ω resistor to the back light.

If you have a Nokia 5100 LCD you can skip the sections on the Virtual Nokia. However, if you do not have a Nokia 5110, you can use the virtual display. Download the starter project for the virtual Nokia as step 8 at http://edx-org-utaustinx.s3.amazonaws.com/UT601x/download.html (http://edx-org-utaustinx.s3.amazonaws.com/UT601x

/download.html). The virtual Nokia system does not run in the simulator, so the proper approach is to use regular Nokia 5110 software and debug in the simulator. After it runs in the simulator switch over and debug in the the project on the real board with the virtual Nokia. Look inside the VirtualNokia5110.c file on line 37 you will find this code

#define VIRTUAL_NOKIA 0

Help

This line defines the hardware configuration. Specify 0 to simulate or to use a real Nokia 5110 LCD. Specify 1 in line 37 to activate the virtual Nokia. In particular, to activate the virtual Nokia feature change line 37 to

#define VIRTUAL_NOKIA 1

In virtual mode, the LaunchPad is connected to PC through debugging USB cable and TExaSdisplay is running on PC with COM port open. The following video demonstrates the usage of the virtual display.

VIDEO VIRTUAL NOKIA DISPLAY

0:00 / 5:15 1.0x

DR. JONATHAN VALVANO: OK.

Let me show you how to run programs on the virtual Nokia display.

I've downloaded the last patch, and I'm going

to open the virtual Nokia display application.

There we are.

Now, we're in Keil, and this starter file is just like the other one