Diglog Reference

Diglog is a powerful circuit creation and simulation program. You'll use diglog for some assignments and to use the moon computers. What follows is a (hopefully) handy reference on how to accomplish basic tasks using Diglog.

Diglog Basics

To start diglog, go into a shell window and type 'diglog'. When diglog starts up, you will see two windows. The larger window (mylib) is where you design the circuit, while the smaller window (newcrt) is where you respond to questions. At the bottom of the circuit design window are some gates and a few words. Four of these words (Frills, Editing, Cursor, or Misc) are menus. To select items in the menus, click and hold on one of the menu words, move the mouse over the command to execute and release the button. To pick up a gate and place it in your circuit, click and drag the gate to the desired location. Releasing the button drops the gate. The gates at the bottom of the circuit design window are your toolbox: there are an unlimited number of gates for you to drag into your design.

In order to connect gates, you must draw wires. To draw a single wire, position the mouse cursor over the gate terminal you want at one end of the wire. Click the left mouse button to start the wire. As you move the cursor, you'll notice a green line follows the cursor. Move the cursor to where you want the wire to end. Diglog can only draw wires at 90 degree angles, so it may not be able to connect the two terminals with a single straight wire. Click the left mouse button and diglog will "bend" the wire 90 degrees and continue drawing. When you've connected the wire to the end terminal, click the right mouse button to stop drawing the wire. This constant clicking may seem a little strange, but you'll get used to it.

You can move wires and gates by dragging them around the screen. To throw away gates and wires, drag them to the toolbox area of the screen and release the button. When you cross wires at a T intersection, diglog automatically solders the two wires together, connecting them. Otherwise, if you cross wires, they won't be connected. Solders are indicated by a dot at the crossing of the two wires.

In the lower right corner of the screen is the word ROT. This tells you that

when you tap a gate, it will rotate 90 degrees. If you start clicking on ROT, it will change to MIR-, then MIR—, then CNFG, and finally back to ROT. In MIR mode, tapping on the gates will mirror them left to right. In MIR bar mode, the gates will be mirrored up and down. If you click on a gate in CNFG mode, some information about the gate will appear in the small (newcrt) window if the gate is configurable. You can change the traits of a gate this way.

Your circuit drawing area is actually much larger than can be displayed on the screen. To scroll this area, use the arrow keys. To zoom up and down on the design area, use the < and > keys. To return to the center of the drawing area, press the HOME key. Diglog also has nine circuit drawing pages. By default, the program starts on page one. To access other pages, use the number keys.

If you need a gate that is not in the toolbox, tap CAT at the bottom of the screen to see a screen with more gates. Tap on a gate to add it to your design.

Circuit Editing

Diglog allows you to copy, cut, paste and delete elements. The easiest operation to perform is called implicit copy. To do this, click and drag a box around the elements to copy or move. A dashed line will appear around the area you've selected and the elements' color will be inverted. You can now move these elements by moving the mouse. Click the left button when the elements are in the desired position. Once you've placed the elements, a copy of these same elements will appear in inverted colors. You can place this copy anywhere you want and another copy will appear. When you done placing copies, press the right mouse button to terminate the operation.

To delete elements, press the d key. The cursor will turn into a pair of scissors. Click and drag a box around the area to delete and it will disappear as soon as you release the button. The cursor will return to its normal shape after the deletion.

Saving and Loading Circuits

To save your circuit, select save under the Misc menu, then type the filename to save under in the small window. Diglog appends the ending .lgf to the file name. If you save the file again, a backup of your last saved file will be created and named <filename>.lfo, where <filename> is the name of your file. When handing in a diglog file, make sure you hand in the .lgf file.

To load a diglog circuit, select load in the Misc menu and type in the name in the small window.

If you need more help, tap on the word help at the bottom of the screen. Diglog has more commands than those listed here.

Diglog Problems

Diglog simulates your circuit continuously. Green wires are unconnected, red wires are high (logical 1), and gray wires are low (logical 0). If a wire is flashing, that means it's being driven both high and low at the same time.

Also, diglog is rather buggy and has a tendency to crash, so save your work often (see below).

Getting New Elements from the Library

Sometimes you may want an element in your design that is not in the catalog. You can get new elements from the library. The library is a large collection of circuit elements, organized in categories, that can be added to the catalog, from which they can be added to the main screen.

From the catalog, click on one of the LIBR buttons to bring up the library in the newcrt window. Most of the elements in the library have short descriptions. Note that you use the + and - keys to cycle through the pages of elements.

Yellow elements are already in the catalog. Click on a green element to add it to the catalog. If you hit spacebar while the library is open, it will close, and leave you in your catalog.

Finding the exact element you need can be a pain. Make sure the text

description and the picture exactly match the element you need; we'll try to specify them precisely. If you are thinking about using an unusual gate or chip, please check with a TA first and carefully document your choice.

Soldering

Some wires that overlap connect; others do not. You know that two touching wires are connected if there is a large dot at the intersection. If there is no such dot, the wires are not connected. If the wires in question meet in a T there will always be such a dot at their intersection. But if your wires cross in a +, you can "solder" and "unsolder" by clicking on the intersection.

Copy/Paste/Move

Copy, move, and paste (under the "Editing" menu) have subtly different meanings; experiment with something that doesn't matter to discover their effects. Also try just dragging a box around stuff in the drawing, then moving it; this works differently from any of the above.

Save/Load

These functions are hidden in the "Misc" menu. Note that when you try to save or load a file, Diglog prompts you for more information in the newcrt window. Diglog uses .lgf as its file extension, and saves backup copies as .lgo. SAVE OFTEN. SAVE OFTEN. SAVE OFTEN. Don't say we didn't tell you at least three times.

Modes

: When you start Diglog, there will be a clock and the word "ROT" in the lower right corner of the mylib window. They change to show what mode Diglog is currently in. You can change the clock to "MOVE", "CUT", "COPY", or "DEL" from the "Editing" menu. When it shows the time, the second field takes precedence. You can cycle the second field by clicking on it. If the second field shows "ROT", "MIR-", or "MIR—" then clicking

on an element will rotate it or flip it about one axis. If the second field shows "CNFG" it lets you set attributes of the more complicated elements. For example, you can set the rate of a clock, or the contents of a ROM. Remember when using CNFG mode that it usually uses the newcrt window to request more information. Most of the simple chips have nothing to configure, so clicking on them in CNFG mode won't actually do anything.

Plotting

"Plotting" is the way that you can make Diglog print to a file. Sometimes, you may want a hard copy of your design, perhaps so you can look at it away from the computer. To do this, choose "Plotting" from the "Misc" menu. This will bring up the plotting screen in the mylib window. There are several buttons on this screen, not all of which work. Click on the "Config" button. Now the newcrt window will show a list of options. Don't mess with any of these except for the "Output file name:" field. Use the up and down arrows to highlight the contents of that field, and press shift-backspace. This will clear the field. Type in the file name you want to print to. It will make sure that your filename ends in .ps because it is generating a postscript file. Now click once anywhere in the mylib window to close the configuration menu. Finally, click the "File" button from the plotting screen in the mylib window.

Race Conditions

Sometimes you may be unfortunate enough to accidentally connect two wires that have different values (i.e. one of them is red, and one is white). If this happens, you will have what is called a race condition. The wire in question will flash rapidly between red and gray, and Diglog will slow down remarkably (this is an understatement). Be calm. From the "Cursor" menu, select "Glow." This will turn off Glow mode, which should stop the wires from flashing. Hit "d" to switch into delete mode, then snip away the offending wires or gates until you have disconnected the racing wires. Now turn Glow mode back on by selecting "Glow" from the "Cursor" menu again. If wires still flash, you've left something connected that shouldn't be. You can also just snip away the wires without turning Glow mode off, but if you do, keep in mind that the race conditions make Diglog use a lot of processor

time, so your deletion may be slow. Just be patient, and things should be okay.

RAM Chips

You will receive at least one assignment where you need to use a RAM chip. These chips can be a bit tricky to use, so to save you some headaches it is described in full detail here.

The name of the chip you want to use is SRAM8K, and it lives in the library of the catalog in Group 1. The way the chip works for both reading and writing is as follows: the eight wires on the chip's bottom side (at least they're on the bottom of the chip's initial position) serve as both input and output. The other long side of pins are used to address the memory for both operations. So it has 8 bits of data (1 byte) and 13 bits of addressing (8192 addresses) - do the math and you end up with a 8k of memory!

First of all, to really use the chip as a RAM, you must configure it to not be a ROM. Go into CNFG mode by typing "c", then click on the RAM chip. Set the "Mode:" field to "Deposit" instead of "Read-only." The chip is now able to receive input in addition to output. Wire the address pins to wherever you're getting the address from, and wire the data pins to wherever you want the data to go to for reading and come from for writing. Then you have to set up the three controls on the RAM:

> **(clock)** - RAM is level-activated, not edge-activated. This means that data gets written when the clock is low, not when the clock transitions from low to high. In fact, when the clock goes high, the RAM is effectively disconnected from the data pins. Registers, by contrast, are edge-activated. This difference is not an accident - it actually allows RAM and registers to work together quite nicely.

OE (output enable) - This acts as a tri-state control, but in reverse. So when OE is high, the RAM is isolated from all

data pins - both for reading and writing. So OE must be low for both reading and writing.

R (read) - This should be high for reading, low for writing. This means that it should be high at all times unless you want to write to memory!

Table 1: Some useful key accelerators.

Key	function
d	delete mode
l	label
x	Cut (only when something is selected)
m	move
c	configure
Arrow Keys	scroll layout
> and <	zoom in and out
1-9	go to page n (the page number is displayed in the upper right corner of the mylib window)

Table 2: Troubleshooting

Symptom	Possible problem	Solution to try
Wires flashing, Diglog slow	race conditions	Turn off "Glow "mode from the "Cursor" menu. Delete or disconnect wire segments and gates that connect wires of opposing values. Now turn "Glow" mode back on.
Can't find your design	on the wrong page	Hit "1" to go back to page 1.
Can't find your design	scrolled or zoomed away	Select "Home" from the "Cursor" menu
Nothing seems to respond to your actions	query pending on the newcrt window	Look at the newcrt window and do what it tells you
Mouse acts differently than you expect	in the wrong mode	Click on the two fields in the lower right corner of the mylib window to select the right mode. Right-clicking anywhere also usually gets you out of any weird modes you get stuck in.
Gates or wires don't seem to be connected correctly	missing a red dot on a pin	Look carefully at the connections at the edges of gates. Make certain the wires touch the red dots at the end of the pins.