Throughout EEL3701, we will be using Intel's Quartus Prime software suite to design, simulate, and compile digital circuit designs for use on the DE10-Lite FPGA Development Board. The installation of Quartus Prime will take multiple steps. Make sure to install both Quartus and one simulator, either ModelSim or Questa. I would recommend using ModelSim as your simulator because it does not require a license. The Questa simulator has a more complicated setup but works better on Linux.

Quartus Installation Instructions	2
Quartus Installation for Windows 10/11	2
Quartus Installation for Linux	5
Quartus Installation for Intel Macs	8
Quartus Installation for ARM Macs	8
Simulator Installation Instructions	9
Modelsim Installation for Windows 10/11	9
Modelsim Installation for Linux	11
Questa Installation for Windows 10/11	14
Questa Installation for Linux	18
Appendices	22
Obtaining a Questa License	22
Sources	24

Quartus Installation Instructions

Quartus Installation for Windows 10/11

- 1. Go to the <u>Quartus Prime Lite 22.1.1 Windows download page</u> and select the "Individual Files" tab of the website, as shown in the red rectangle. (Note that newer version may be available but should <u>NOT</u> be installed.)
- 2. You only need to download, the following, as shown with arrows on the left:
 - a) Intel Quartus Prime (includes Nios II EDS)
 - b) Intel MAX 10 FPGA Device Support
 - c) Intel MAX II, Intel MAX V Device Support
 - d) Intel Cyclone V Device Support

Multiple Download Individual Files / dditional Software	Copyleft Licensed Source
ntel® Quartus® Software	
Intel® Quartus® Prime (includes Nios II EDS)	
Download QuartusLiteSetup-22.1std.1.917-windows.exe	Size: 1.6 GB SHA1: 3694a64cc8253450ad7682a552396f7e292dad09
** Nios® II EDS on Windows requires Ubuntu 18.04 LTS on Window ** Nios® II EDS requires you to install an Eclipse IDE manually. ** Installation size: 8.86 GB	- /s Subsystem for Linux (WSL), which requires a manual installation.
Questa* - Intel® FPGA Edition	
Download QuestaSetup-22.1std.1.917-windows.exe	Size: 780.1 MB SHA1: 61219c4ba8cd88d51a87dfe5623ff6bacf346185
** Installation size: 2.73 GB	
Devices	
Intel® Arrin® II device cupport	
Download	Size: 499.1 MB
arria_lite-22.1std.1.917.qdz	SHA1: e9d3ce3a3a8581576f1a33c63a306c922tdd617d
Intel® Cyclone® IV device support	
Download cvclone-22.1std.1.917.gdz	Size: 465.8 MB SHA1: cbbfc3ffdcee8a2535b9e129bd7444f3fa18b71f
** Installation size: 0.50 GB	I
Intel® Cyclone® 10 LP device support	
Download cyclone10lp-22.1std.1.917.qdz	Size: 265.5 MB SHA1: a26747672b0e8f48c0e6691760760b3ce60cba42
** Installation size: 0.29 GB	
Intel® Cyclone® V device support	5. 40.5D
Download cyclonev-22.1std.1.917.qdz	Size: 1.3 GB SHA1: 379e51b9e908cd43b9515f93f42f2a230a405a60
** Installation size: 1.40 GB	
Intel® MAX® II, Intel® MAX® V device support	Size: 11.4 MB
Download max-22.1std.1.917.qdz	SHA1: 003f41439dc18b20c58177a329d8afa132869886
** Installation size: 0.01 GB	

Dr. Eric M. Schwartz Matthew Hershfield, Jackson Fugate 9-Oct-23

Revision **0 Quartus Installation Instructions** (Last Updated for Quartus v22.1.1)

EEL 3701

- 3. Select each of the files specified above for download. You may need to accept license agreements for some of the downloaded files.
- 4. After the Quartus software has finished downloading, run the below installation file to install the Quartus software.

QuartusLiteSetup-22.1std.1.917-windows.exe

Note that the numbers after the 22 might change as new versions become available.

- a) Windows may tell you that it is not safe to run this program with something like Windows protected your PC. Ignore this message. Select More info or something similar to get Windows to continue and then select Run anyway.
- b) Leave all default options in the installer and select Next each time it is necessary.
- c) When the Finish option is presented, de-select Launch USB Blaster II driver installation and Run the Quartus Prime Software and then select Finish.
- 5. If you have a High DPI display, some Quartus programs such as the simulation editor will not look correct. To fix this problem, navigate to C:\intelFPGA_lite\22.1std\quartus\bin64 and find quartus.exe. Right click on quartus.exe and choose Properties. Click on the Compatibility tab and click on the button labelled Change high DPI settings. In the window that appears, check the checkbox next to Override high DPI scaling behavior and choose the System (Enhanced) option in the dropdown menu. Click OK on the High DPI settings window and then Apply on the properties window.

× 🖿 bin64	× + -	o x	🕥 Quartus (Quartus Prime 22.1std) Properties 🛛 🗙	
ெ © © ⊕ ↑	∜ Sort ~		Security Details Previous Versions General Shortcut Compatibility	
≪ quartus > bin64 > → ∨ (Den Enter		If this program isn't working correctly on this version of Windows, try running the compatibility troubleshooter.	
Name ^	🕞 Run as administrator		Run compatibility troubleshooter	
Ot5OuickWidgets.dll	🔗 Pin to Start	tension	How do I choose compatibility settings manually?	
Qt5Script.dll	🟠 Add to Favorites	tension	Compatibility mode Run this program in compatibility mode for:	
🗟 Qt5Sql.dll	Compress to ZIP file	tension	Windows 8	High DPI settings for quartus.exe X
🖏 Qt5Svg.dll	Copy as path Ctrl+Shift+C	tension	Sattinge	Choose the high DPI settings for this program.
🗟 Qt5Test.dll	Properties Alt+Enter	tension	Reduced color mode	Use this setting to fix scaling problems for this program
🖏 Qt5Widgets.dll	OneDrive >	tension	8-bit (256) color \sim	Open Advanced scaling settings
🔮 Qt5Xml.dll	57 Show more options Shift+F10	tension	Run in 640 x 480 screen resolution	changes after you sign in to Windows. Windows can try to fix this scaling problem for this program by using the DPI that's
🔽 🛜 quartus.exe			Disable fullscreen optimizations	set for your main display when you open this program.
🔲 quartus_asm.exe			Register this program for restart	I signed in to Windows
quartus_cdb.exe	2/15/2023 6:24 AM Application		Use legacy display ICC color management	Learn more
quartus_cloud.exe	2/15/2023 6:24 AM Application		Change high DPI settings	High DPI scaling override
quartus_cmd.exe	2/15/2023 6:24 AM Application			Override high DPI scaling behavior. Scaling performed by:
uartus_cpf.exe	2/15/2023 6:24 AM Application		Change settings for all users	System (Enhanced)
ted 219 KB			OK Cancel Apply	OK Cancel

University of Florida Department of Electrical & Computer Engineering Page 4/24

EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

6. When the installation is done, run the Quartus software from the Start menu or the desktop shortcut. When a Quartus Prime 22.1 Lite Edition window appears (see below), select the second option (as shown), i.e., Run the Quartus Prime software and then select OK. I suggest that you drag the Quartus desktop icon into your Taskbar for easiest access.



S Quartus Prime 22.1 Lite Edition	×			
Thank you for installing the Quartus Prime software - the #1 in performance and productivity. To upgrade to a full featured edition, please https://www.intel.com/content/www/us/en/products/programmable.html.				
Select one of the following licensing options to continue:				
Select one of the following options				
O Buy a Quartus Prime software license				
Run the Quartus Prime software				
○ Add an IP license file (for users who have purchased IP)				
OK Can	cel			

University of Florida Department of Electrical & Computer Engineering Page 5/24

EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

Quartus Installation for Linux

The installation directions provided in this document were designed for default Ubuntu 22.04 LTS, as this is the most recent distribution that is officially supported by Quartus.

- 1. Go to the <u>Quartus Prime Lite 22.1.1 Linux download page</u> and select the "Individual Files" tab of the website, as shown in the red rectangle. (Note that newer version may be available but should <u>NOT</u> be installed.)
- 2. You only need to download, the following, as shown with arrows on the left:
 - a) Intel Quartus Prime (includes Nios II EDS)
 - b) Intel MAX 10 FPGA Device Support
 - c) Intel MAX II, Intel MAX V Device Support
 - d) Intel Cyclone V Device Support

Multiple Download Individual Files Additional Software	Copyleft Licensed Source
Intel® Quartus® Software	
Intel® Quartus® Prime (includes Nios II EDS)	
Download QuartusLiteSetup-22.1std.1.917-linux.run	Size: 1.8 GB v SHA1: d1923058d69fe8c0593486d2a0b430133a48dd39
** Nios® II EDS requires you to install an Eclipse IDE manually. ** Installation size: 8.33 GB	
Questa* - Intel® FPGA Edition	
Download QuestaSetup-22.1std.1.917-linux.run	Size: 1.6 GB v SHA1: a10a65aecdf2b2d2bfbfaf1fa159d938b3cab4bf
** Installation size: 4.09 GB	
Devices	
Intel® Arria® II device support	
Download arria_lite-22.1std.1.917.qdz	Size: 499.1 MB SHA1: e9d3ce3a3a8581576f1a33c63a306c922fdd617d
** Installation size: 0.52 GB	
Intel® Cyclone® IV device support	
Download cyclone-22.1std.1.917.qdz	Size: 465.8 MB SHA1: cbbfc3ffdcee8a2535b9e129bd7444f3fa18b71f
** Installation size: 0.50 GB	
Intel® Cyclone® 10 LP device support	
Download cyclone10lp-22.1std.1.917.qdz	Size: 265.5 MB SHA1: a26747672b0e8f48c0e6691760760b3ce60cba42
** Installation size: 0.29 GB	
Intel® Cyclone® V device support	
Download cyclonev-22.1std.1.917.qdz	Size: 1.3 GB SHA1: 379e51b9e908cd43b9515f93f42f2a230a405a60
** Installation size: 1.40 GB	
Intel® MAX® II, Intel® MAX® V device support	
Download max-22.1std.1.917.qdz	Size: 11.4 MB SHA1: 003f41439dc18b20c58177a329d8afa132869886
** Installation size: 0.01 GB	
Intel® MAX® 10 FPGA device support	
Download max10-22.1std.1.917.qdz	Size: 286.4 MB v SHA1: c3a42e7dedae4ffad45320062b4492818df74f5e
** Installation size: 0.35 GB	

- 3. Select each of the files specified above for download. You may need to accept license agreements for some of the downloaded files.
- 4. Open a terminal and navigate to your Downloads folder. We can then run the Quartus installer by issuing the following commands. Make sure that you do not run the Quartus installer as root!

```
chmod +x QuartusLiteSetup-22.1std.1.917-linux.run
./QuartusLiteSetup-22.1std.1.917-linux.run
```

- a) Leave all default options in the installer and select Next each time it is necessary.
- b) When the Finish option is presented, de-select Run the Quartus Prime Software and then select Finish.
- 5. To allow easy access to your Quartus installation, create a text file called quartus.desktop using the text editor of your choice and copy the following contents into it. Make sure to change YOURUSERNAME to the username of the account that you installed Quartus for.

```
[Desktop Entry]
Version=1.0
Type=Application
Terminal=false
Exec=/home/YOURUSERNAME/intelFPGA_lite/22.1std/quartus/bin/quartus
Name=Quartus
Icon=/home/YOURUSERNAME/intelFPGA_lite/22.1std/quartus/adm/quartusii.png
```

- a) If your distribution supports desktop icons, you can copy this file to your Desktop folder and it will work as a desktop shortcut
- b) To add a Quartus shortcut to your Apps menu, copy this file to ~/.local/share/applications, creating that folder if necessary. This was tested for GNOME 44.
- 6. To allow Quartus to program your DE10-Lite board, we must add a udev rule enabling access to the USB-Blaster programming hardware on the DE10-Lite. Create the text file /etc/udev/rules.d/51altera-usb-blaster.rules (requires superuser privileges) and populate it with the following:

```
SUBSYSTEM=="usb", ATTR{idVendor}=="09fb", ATTR{idProduct}=="6001", MODE="0666"
SUBSYSTEM=="usb", ATTR{idVendor}=="09fb", ATTR{idProduct}=="6002", MODE="0666"
SUBSYSTEM=="usb", ATTR{idVendor}=="09fb", ATTR{idProduct}=="6010", MODE="0666"
SUBSYSTEM=="usb", ATTR{idVendor}=="09fb", ATTR{idProduct}=="6010", MODE="0666"
SUBSYSTEM=="usb", ATTR{idVendor}=="09fb", ATTR{idProduct}=="6810", MODE="0666"
```

- 7. Restart your computer so that the new udev rules take effect.
- 8. Many Linux systems still encounter a permissions error when trying to connect to the USB Blaster, even after adjusting the udev rules. This shows up in an "Unable to read device chain JTAG chain broken" error while using the programmer. This can be remediated by adjusting the JTAG daemon's settings. Run the following in a terminal:

```
killall jtagd
cd ~/intelFPGA_lite/22.1std/quartus/bin
sudo mkdir /etc/jtagd
sudo cp ../linux64/pgm_parts.txt /etc/jtagd/jtagd.pgm_parts
./jtagd
```

University of Florida Department of Electrical & Computer Engineering Page 7/24

EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

9. You can verify that you are able to program your DE10-Lite by disconnecting and reconnecting it to your computer and running ./jtagconfig in the same terminal you ran the above commands. If your setup is correct, you should see output that looks like:

1)	USB-Blaster [1-2]	
	031050DD 10M50DA(. ES)/10M50DC	

10. Run Quartus using either the .desktop file we made earlier or by running ~/intelFPGA_lite/22.1std/quartus/bin/quartus. In the window that appears, select Run the Quartus Prime software and then select OK.

Quartus Prime 22.1 Lite Edition	×
Thank you for installing the Quartus Prime software - the #1 in performance and productivity. To upgrade to a full featured edition, please https://www.intel.com/content/www/us/en/products/programmable.html.	
Select one of the following licensing options to continue: Select one of the following options	
O Buy a Quartus Prime software license	
Run the Quartus Prime software	
○ Add an IP license file (for users who have purchased IP)	
OK Can	cel

Quartus Installation for Intel Macs

The best way to run Quartus on an Intel Mac is to dual boot Windows on your device by setting up Bootcamp. Students have also had success running the Windows version of Quartus through Parallels and other virtual machine software. Macs are not officially supported in this course, so you may need to do additional troubleshooting to get everything working correctly. See the Windows tutorials for installing Quartus and a simulator for more information.

Quartus Installation for ARM Macs

Quartus is x86 software and it has no native Mac port, so the best way to get it running is to run it in a Linux VM with the FEX x86 emulator. I have chosen to use UTM (free VM software) for this tutorial, but you could also do this in Parallels (paid) if you prefer. M1 Macs are not officially supported in this course, so you may need to do additional troubleshooting to get everything working correctly.

- 1. Download UTM from <u>https://docs.getutm.app/installation/macos/</u>. You can download it for free by clicking Download from Github. Install UTM like you would install any other Mac application.
- 2. Download Ubuntu Desktop 22.04's ARM ISO from https://cdimage.ubuntu.com/jammy/daily-live/current/. The file should be called jammy-desktop-arm64.iso.
- 3. Open UTM. Choose New VM, then Virtualize, then Linux. Make sure to use the default QEMU backend instead of Apple Virtualization. Quartus does not work on Apple Virtualization VMs yet. For the VM specifications, I recommend using at least 4096 MB of RAM but only one CPU core. From our testing, using multiple CPU cores in your VM will reduce Quartus's performance substantially. The disk size should be at least 32 GB, though more is recommended. For the boot image, select the jammy-desktop-arm64.iso you downloaded earlier.
- 4. Start the virtual machine. Once you are booted into a desktop, choose Install Ubuntu and fill out the settings for the installer. Make sure to do a minimal installation because this will make sure there is sufficient disk space for Quartus to install. The installation will take 10-30 minutes depending on your computer.
- 5. Once the installation is completed, shut down the virtual machine. From the UTM VM info page, remove jammy-desktop-arm64.iso from the disk drive. Power on the VM and log in using the username and password you set up during the installation. A first boot window will appear with information about Ubuntu, and you can click through it without installing any additional software.
- 6. From the applications grid in the bottom left of the screen, open up a terminal and run the following commands to update your system and install necessary packages. These commands will have you enter your password, and what you type for your password will be completely hidden. This is normal.

```
sudo apt update
sudo apt upgrade
sudo apt install curl
```

7. Install the FEX x86 emulator by running the following command (all one line). You will be prompted to enter your password.

curl	silent	https://raw.githubusercontent.com/FEX-
Emu/FE	<pre>X/main/Scripts/InstallFEX.py</pre>	output /tmp/InstallFEX.py && python3
/tmp/I	nstallFEX.py && rm /tmp/Insta	allFEX.py

- 8. The installer will prompt you for some options. You should have the installer download and install a rootfs automatically and set it as the default. You should be able to answer 'y' for every question it asks.
- 9. In a terminal, enter the FEX environment by typing FEXBash. You can now follow the Linux installation instructions to install Quartus within the FEXBash environment.
 - a. The only modification you need to make to the installation process is to insert FEXBash before the Exec command in the Quartus desktop entry if you decide to make one.
- 10. Anytime you want to run Quartus, you must start it from within a FEXBash environment.

University of Florida Department of Electrical & Computer Engineering Page 9/24

EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

Simulator Installation Instructions

Modelsim Installation for Windows 10/11

Modelsim is a free simulator that doesn't require a license to use. We will install Modelsim 19.1, the last version of Modelsim released by Intel.

- 1. Go to the <u>Quartus Prime Lite 19.1 Windows download page</u> and select the "Individual Files" tab of the website, as shown in the red rectangle. (Note that newer version may be available but should <u>NOT</u> be installed.)
- 2. You only need to download ModelSim-Intel FPGA Edition (includes Starter Edition, as shown by the arrow on the left. You may need to accept a license agreement.

Downloads

Multiple Download Individual Files Additional Softv	vare Copyleft Licensed Source
ntel® Quartus® Software	
ModelSim-Intel® FPGA Edition (includes Starter Edition)
Download ModelSimSetup-19.1.0.670-windows.exe	Size: 968.2 MB SHA1: e3ebbfc01c653892decdf7f18c2a3862ccc36954
Intel® Quartus® Prime (includes Nios® II EDS)	
Download QuartusLiteSetup-19.1.0.670-windows.exe	Size: 1.5 GB SHA1: f3de26a3a6288b6258aebe7d89a406ba22330684
** Nios [®] II EDS on Windows requires Ubuntu 18.04 LTS on Wir ** Nios [®] II EDS requires you to install an Eclipse IDE manually.	ndows Subsystem for Linux (WSL), which requires a manual installation.

Devices

Intel® Arria® II Device Support. (536.5MB)		~
Download arria_lite-19.1.0.670.qdz	Size: 499.1 MB SHA1: 602527e267e23673abacac6926bc2081b485d0a8	~
Intel® MAX® 10 Device Support. (343.3MB)		
Download max10-19.1.0.670.qdz	Size: 332.8 MB SHA1: cd99cd6e153867499e6a460d89661940f59ac60a	*
Intel® MAX® II, Intel® MAX® V Device Support. (13.1MB)		
Download max-19.1.0.670.qdz	Size: 11.4 MB SHA1: 90a3be6febda19ef0c4140b0ececf0798b1f38a5	
Intel® Cyclone® IV Device Support. (516.3MB)		
Download cyclone-19.1.0.670.qdz	Size: 466 MB SHA1: 8ec1a1aff0374be90371121eff351ca4ec17ea3c	
Intel® Cyclone® 10 LP Device Support. (293.5MB)		
Download cyclone10lp-19.1.0.670.qdz	Size: 265.7 MB SHA1: b2622b757b842d83890a7e1c1fee65448cc76d8f	~
Intel® Cyclone® V Device Support. (1434.3MB)		
Download cyclonev-19.1.0.670.qdz	Size: 1.3 GB SHA1: a618a94985875978f5b19aad64cfa78c60c33370	~

3. After Modelsim has finished downloading, run the following file to install it.

ModelSimSetup-19.1.0.670-windows.exe

Note that the numbers after the 22 might change as new versions become available.

- a) Windows may tell you that it is not safe to run this program with something like Windows protected your PC. Ignore this message. Select More info or something similar to get Windows to continue and then select Run anyway.
- 4. When prompted to select which version of ModelSim you want to install, choose to install ModelSim Starter Edition

a) Leave all default options in the installer and select Next each time it is necessary.

Installing ModelSim - Intel FPGA Edition or Starter Edition 10.5b (Quartus Print)	me 19.1.0.670) (32	-		×
Select the ModelSim edition you like to install			(inte	
ModelSim - Intel FPGA Starter Edition - License is not required. ModelSim - Intel FPGA Edition - License is required.				
InstallBuilder	< Back Ne	ext >	Cance	4

5. Once the installation has completed, open Quartus and navigate to Tools->Options. In the Options window, select EDA Tool Options in the left panel. In the text box next to the ModelSim label, insert the path to Modelsim's win32aloem folder. The default install location uses the path C:/intelFPGA/19.1/modelsim_ase/win32aloem. Click OK to save the simulator settings. Now you will be able to use ModelSim from the Quartus VWF editor.

Quartus Prime Lite Edition <u>F</u> ile <u>E</u> dit <u>V</u> iew <u>P</u> roject <u>A</u> ssignments P <u>r</u> ocessii	ng <u>Tools W</u> indow <u>H</u> elp		S Options			×
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Project Navigator 🍐 Hierarchy 🔹 🤉 🕷 🐐	Ho 🗞 Launch Design Space Explorer II		🔻 General	EDA Tool Opti	ons	
Compilation Hierarchy	c S Timing Analyzer		EDA Tool Options	Specify the dir	ectory that contains the tool executable for each third-party EDA too	ol:
DLa Dde	Lat Advisors	pf)	Fonts	EDA Tool	Directory Containing Tool Executable	
	de' 🛇 C <u>h</u> ip Planner tes 🏠 Design Partition Planner	te.qpf) _prog.qp	Internet Connectivi	Precision Sy		
	Netlist Viewers	•	Libraries	Synplify		
	🧈 Signal Tap Logic A <u>n</u> alyzer	🔗 Орі	 IP Settings 	Synplify Pro		
-	- In-System Memory Content Editor		IP Catalog Searc	Active-HDL		
6	Logic Analyzer Interface Editor	nining	License Setup	Riviera-PRO		
	Signal Probe Pins	annig	Preferred Text Edit	ModelSim	C:/intelFPGA/19.1/modelsim_ase/win32aloem	-
Tasks Compilation 👻 = 🖲 🛙 👁	♦ Programmer		Processing	QuestaSim		-
Task	💐 JTAG Chain Debugger		Tooltip Settings			-
▼ ► Compile Design	Fault Injection Debugger		 Messages 	Questa Intel		•
► P Analysis & Synthesis	System Debugging Tools	•	Colors			
► Fitter (Place & Route)	IP Catalog		Fonts			
Assembler (Generate program	Nios II Software Build Tools for Eclipse					
► Filming Analysis	A Platform Designer					
	On / Tcl Scripts					
8 All 8 ▲ ▲ ▼ < <filter>></filter>	Customi <u>z</u> e					
Type ID Message	Options					
.,po io noongo	License Setup					
	🕞 Install Devices					
s a						
ž system Processing			4 Þ		OK Cancel He	lp
Changes user preferences and options						

University of Florida Department of Electrical & Computer Engineering Page 11/24

EEL 3701 Revision **0** Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

Modelsim Installation for Linux

Modelsim is a free simulator that doesn't require a license to use. We will install Modelsim 19.1, the last version of Modelsim released by Intel. This installation guide was designed for stock Ubuntu 22.04 LTS.

- 1. Go to the <u>Quartus Prime Lite 19.1 Linux download page</u> and select the "Individual Files" tab of the website, as shown in the red rectangle. (Note that newer version may be available but should <u>NOT</u> be installed.)
- 2. You only need to download ModelSim-Intel FPGA Edition (includes Starter Edition, as shown by the arrow on the left. You may need to accept a license agreement.

```
Downloads
  Multiple Download
                        Individual Files
                                           Additional Software
                                                                  Copyleft Licensed Source
Devices
  Intel® Arria® II Device Support. (536.5MB)
                                                                 Size: 499.1 MB
                            Download
                                                                 SHA1: 602527e267e23673abacac6926bc2081b485d0a8
                     arria_lite-19.1.0.670.qdz
  Intel® Cyclone® IV Device Support. (516.3MB)
                                                                 Size: 466 MB
                           Download
                                                                 SHA1: 8ec1a1aff0374be90371121eff351ca4ec17ea3c
                     cyclone-19.1.0.670.qdz
  Intel® Cyclone® 10 LP Device Support, (293.5MB)
                                                                 Size: 265.7 MB
                           Download
                                                                 SHA1: b2622b757b842d83890a7e1c1fee65448cc76d8f
                   cyclone10lp-19.1.0.670.qdz
  Intel<sup>®</sup> Cyclone<sup>®</sup> V Device Support, (1434,3MB)
                                                                 Size: 1.3 GB
                           Download
                                                                 SHA1: a618a94985875978f5b19aad64cfa78c60c33370
                     cyclonev-19.1.0.670.qdz
  Intel® MAX® II, Intel® MAX® V Device Support. (13.1MB)
                                                                 Size: 11.4 MB
                                                                 SHA1: 90a3be6febda19ef0c4140b0ececf0798b1f38a5
                       max-19.1.0.670.qdz
  Intel® MAX® 10 Device Support. (343.3MB)
                                                                 Size: 332.8 MB
                            Download
                                                                 SHA1: cd99cd6e153867499e6a460d89661940f59ac60a
                      max10-19.1.0.670.gdz
Intel® Quartus® Software
  ModelSim-Intel® FPGA Edition (includes Starter Edition)
                                                                 Size: 998.7 MB
                           Download
                                                                 SHA1: 354404a6fb70dd7837fe27a0cce262eada9c1d86
               ModelSimSetup-19.1.0.670-linux.run
  Intel® Ouartus® Prime (includes Nios® II EDS)
                                                                 Size: 1.8 GB
```

SHA1: ea512441cd6658c3e0225c85ccc09417110ab572

** Nios® II EDS requires you to install an Eclipse IDE manually.

QuartusLiteSetup-19.1.0.670-linux.run

3. Open a terminal and Open a terminal and navigate to your Downloads folder. We can then run the ModelSim installer by issuing the following commands. Make sure that you do not run the ModelSim installer as root!

chmod +x ModelSimSetup-19.1.0.670-linux.run

./ModelSimSetup-19.1.0.670-linux.run

4. When prompted to select which version of ModelSim you want to install, choose to install ModelSim Starter Edition

University of Florida Department of Electrical & Computer Engineering Page 12/24 EEL 3701 Revision **0 Quartus Installation Instructions** (Last Updated for Quartus v22.1.1)

a) Leave all default options in the installer and select Next each time it is necessary.

Installing ModelSim - Intel FPGA Edition or Starter Edi	ition 10.5b (Quartus Prime 19 🗕 🙁
Select the ModelSim edition you like to install	(intel)
 ModelSim - Intel FPGA Starter Edition License is not required. ModelSim - Intel FPGA Edition 	
InstallBuilder	< Back Next > Cancel

5. ModelSim uses a number of old 32-bit dependencies that we must install. Luckily, these packages can still be found in Ubuntu's repositories. To install these packages, open a terminal and run

```
sudo dpkg --add-architecture i386
sudo apt update
sudo apt upgrade
sudo apt install libc6:i386 libncurses5:i386 libstdc++6:i386 \
lib32ncurses6 libxft2 libxft2:i386 libxext6 libxext6:i386
```

- 6. To force Modelsim to use the libraries we just installed, we must edit its launch script. Use the text editor of your choice to edit ~/intelFPGA_lite/19.1/modelsim_ase/bin/vsim and make the following changes. You will need superuser privileges to edit this file.
 - a) Change mode=\${MTI VCO MODE:-""} to mode=\${MTI VCO MODE:-"32"}
 - b) Change vco="linux rh60" to vco="linux"

University of Florida Department of Electrical & Computer Engineering Page 13/24

EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

7. Once the installation has completed, open Quartus and navigate to Tools->Options. In the Options window, select EDA Tool Options in the left panel. In the text box next to the ModelSim label, insert the Modelsim's folder. The default install location path to bin uses the path /home/YOURUSERNAME/intelFPGA/19.1/modelsim ase/bin. Click OK to save the simulator settings. Now you will be able to use ModelSim from the Quartus VWF editor.



Unfortunately, the ModelSim GUI (used in Digital Design) does not work when following these installation instructions. I'm not sure if this is due to something being broken in ModelSim or if it can be fixed by installing additional dependencies.

University of Florida Department of Electrical & Computer Engineering Page 14/24 EEL 3701 Revision **0 Quartus Installation Instructions** (Last Updated for Quartus v22.1.1)

Questa Installation for Windows 10/11

- 1. Go to the <u>Quartus Prime Lite 22.1.1 Windows download page</u> and select the "Individual Files" tab of the website, as shown in the red rectangle. (Note that newer version may be available but should <u>NOT</u> be installed.)
- 2. You only need to download Questa Intel FPGA Edition as shown with arrows on the left. You may need to accept a license agreement.

Multiple Download Individual Files / dditional Software	Copyleft Licensed Source
ntel® Quartus® Software	
Intel® Quartus® Prime (includes Nios II EDS)	
Download QuartusLiteSetup-22.1std.1.917-windows.exe	Size: 1.6 GB v SHA1: 3694a64cc8253450ad7682a552396f7e292dad09
** Nios" II EDS on Windows requires Ubuntu 18.04 LTS on Windows ** Nios" II EDS requires you to install an Eclipse IDE manually. ** Installation size: 8.86 GB	s Subsystem for Linux (WSL), which requires a manual installation.
Questa* - Intel® FPGA Edition	
Download QuestaSetup-22.1std.1.917-windows.exe	Size: 780.1 MB SHA1: 61219c4ba8cd88d51a87dfe5623ff6bacf346185
** Installation size: 2.73 GB	
levices	
Intel® Arria® II device support	
Download arria_lite-22.1std.1.917.qdz	Size: 499.1 MB SHA1: e9d3ce3a3a8581576f1a33c63a306c922fdd617d
** Installation size: 0.52 GB	
Intel® Cyclone® IV device support	
Download cyclone-22.1std.1.917.qdz	Size: 465.8 MB SHA1: cbbfc3ffdcee8a2535b9e129bd7444f3fa18b71f
** Installation size: 0.50 GB	
Intel® Cyclone® 10 LP device support	
Download cyclone10lp-22.1std.1.917.qdz	Size: 265.5 MB SHA1: a26747672b0e8f48c0e6691760760b3ce60cba42
** Installation size: 0.29 GB	
Intel® Cyclone® V device support	
Download cyclonev-22.1std.1.917.qdz	Size: 1.3 GB ~ ~ SHA1: 379e51b9e908cd43b9515f93f42f2a230a405a60
** Installation size: 1.40 GB	
Intel® MAX® II, Intel® MAX® V device support	
Download max-22.1std.1.917.qdz	Size: 11.4 MB SHA1: 003f41439dc18b20c58177a329d8afa132869886
** Installation size: 0.01 GB	
Intel® MAX® 10 FPGA device support	
Download max10-22.1std.1.917.qdz	Size: 286.4 MB SHA1: c3a42e7dedae4ffad45320062b4492818df74f5e
** Installation size: 0.35 GB	

University of Florida Department of Electrical & Computer Engineering Page 15/24

EEL 3701 Revision **0** Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

3. After the Quartus software has finished downloading, run the below installation file to install the Quartus software.

QuestaSetup-22.1std.1.917-windows.exe

Note that the numbers after the 22 might change as new versions become available.

- a) Windows may tell you that it is not safe to run this program with something like Windows protected your PC. Ignore this message. Select More info or something similar to get Windows to continue and then select Run anyway.
- 4. When prompted to select which version of Questa you want to install, choose Questa Intel FPGA Starter Edition
 - a) Leave all default options in the installer and select Next each time it is necessary.

Installing Questa - Intel FPGA Edition or Starter Edition 2021.2 (Quartus Prim	ne 22.1s – ×
Select Questa edition you like to install	intel
Questa - Intel FPGA Starter Edition	
This software requires a license. Please sign up for free Early Access license at https://www.intel.com/content/www/us/en/software/programmable/quartus-prime/wl	nats-new.html
VMwara IostallBuildar	
< Back Next	> Cancel

5. To prepare for acquiring a Questa License, we must find the hardware ID number of your network card. Intel uses this number to verify that your computer is licensed to use Questa. Open a Powershell window and run the command ipconfig /all. (without the period) This will list all of the network adapters connected to your computer. Look for your computer's main WiFi or network card in this list and locate its Physical Address. The hardware ID number that you will put into the Intel website is your network adapter's Physical Address with the dashes removed. Save this number for use when requesting your Questa License. For example, the ID number in the below screenshot is c423609f3c29.

- 6. Follow the instructions in Obtaining a Questa License
- 7. Once you have obtained your Questa license, copy it to a safe folder where it won't accidentally get deleted. This tutorial assumes that you create the folder C:\intelFPGA\licenses and copy your license file there.

University of Florida Department of Electrical & Computer Engineering Page 16/24

EEL 3701 Revision **0 Quartus Installation Instructions** (Last Updated for Quartus v22.1.1)

- 8. We need to set the LM_LICENSE_FILE environment variable globally so that Questa knows where to find the license file.
 - a) In the Start menu, search for Edit the system environment variables.
 - b) Click the Environment Variables button in the bottom right corner of the window that appears.
 - c) Under the System Variables section (bottom half of the window), click New.
 - d) In the window that appears, type in LM_LICENSE_FILE for the variable name. To set the variable's value, click the Browse File button in the bottom left corner of the window and navigate to where you stored your license file. Double click on the license file to save its path to the environment variable.
 - e) Click OK to confirm the new environment variable.

System Properties		× Environment Varia	bles			×
Computer Name Hardware Advanced	System Protection Remote	User variables fo	or selma			
You must be logged on as an Administr	ator to make most of these changes	C_INCLUDE_P/ CARBON_MEN	Value ATH C:\Users\selma\sc M_DISABLE 1	oop\apps\gcc\cur	rent\include	
Visual effects, processor scheduling, r	nemory usage, and virtual memory Settings	CPLUS_INCLU Intellij IDEA OneDrive OneDriveCom OneDriveCom Path	DE_PATH C:\Users\selma\sc C:\Program Files\ C:\Users\selma\O mercial C:\Users\selma\O sumer C:\Users\selma\O C:\Users\selma\Sc	oop\apps\gcc\cur letBrains\IntelliJ ID neDrive - Universit neDrive - Universit neDrive oop\apps\gcc\cur	rent\include EA 2021.2.2\bin; y of Florida y of Florida rent\bin:C:\Users'	\selma\scoo
User Profiles				Neur	r Ju	Delete
Desktop settings related to your sign-i	n			New	Edit	Delete
	Settings	System variable	5			
	O <u>o</u> tungs	Variable	Value			
Startup and Recovery		ComSpec	C:\WINDOWS\sys	tem32\cmd.exe	D.I.	
Sustan startun autom failure and de	hugging information	DriverData MITMPROXV	C:\Windows\Syste	m32\Drivers\Drive SL_KEVEILE tyt	er∪ata	
System startup, system failure, and de	bugging information	NUMBER OF	PROCESSORS 8	L_KETTILE.UK		
		OS	Windows_NT			
	Se <u>t</u> tings	Path	C:\Program Files\I	.apce\;C:\Program	Files\Eclipse Add	optium\jre-1
		PATHEXT	.COM;.EXE;.BAT;.C	MD;.VBS;.VBE;.JS;.J	SE;.WSF;.WSH;.M	SC
	Environment Variables		ANUTURE ANUDO4	New	Edit	Delete
Ok	Cancel Apply				ОК	Cancel
lit System Variable						
/ariable name: LM_L	ICENSE_FILE					
/ariable value: C:\int	CelfpGA\licenses\LR-0	87091_License.dat				
Prove Directory	D			OK		C
Browse Directory	Browse File			ОК		Cancel

- 9. Restart your computer for your changes to take effect.
- 10. Once your computer reboots, open a command prompt and run lmutil lmdiag to confirm that your license is found correctly. If your license cannot be verified, double check that your LM_LICENSE_FILE environment variable is set correctly.
- 11. By default, Questa aggressively optimizes your circuit designs so much that the outputs of your simulations will not be visible in the Quartus VWF viewer. To fix this, we need to replace the VWF viewer's library file with a modified version that sets Questa to not optimize your designs while simulating. Download edt_wedtq.dll and copy it into C:\intelFPGA_lite\22.1std\quartus\bin64. Make sure to replace the older version of this file in the destination.

University of Florida Department of Electrical & Computer Engineering Page 17/24

EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

12. Open Quartus and navigate to Tools->Options. In the Options window, select EDA Tool Options in the left panel. In the text boxes next to the Questa and Questa – Intel labels, insert the path to Questa's bin folder. The default install location uses the path C:/intelFPGA/22.1std/questa_fse/win64. Click OK to save the simulator settings. Now you will be able to use Questa from the Quartus VWF editor.



Please note that using Questa from its main GUI (such as in Digital Design) leads to the over-aggressive optimization that can break some simulations. I haven't used Questa much yet, but if I find a workaround to make the Questa GUI behave properly then I will update this document.

University of Florida Department of Electrical & Computer Engineering Page 18/24

EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

Questa Installation for Linux

The installation directions provided in this document were designed for default Ubuntu 22.04 LTS, as this is the most recent distribution that is officially supported by Quartus.

- 1. Go to the <u>Quartus Prime Lite 22.1.1 Linux download page</u> and select the "Individual Files" tab of the website, as shown in the red rectangle. (Note that newer version may be available but should <u>NOT</u> be installed.)
- 2. You only need to download Questa Intel FPGA Edition as shown with arrows on the left. You may need to accept a license agreement.

el® Ouartus® Software	
Intel® Quartus® Prime (includes Nios II EDS)	Size: 1.8 GB
Download QuartusLiteSetup-22.1std.1.917-linux.run	SHA1: d1923058d69fe8c0593486d2a0b430133a48dd39
** Nios® II EDS requires you to install an Eclipse IDE manually. ** Installation size: 8.33 GB	
Questa* - Intel® FPGA Edition	
Download QuestaSetup-22.1std.1.917-linux.run	Size: 1.6 GB SHA1: a10a65aecdf2b2d2bfbfaf1fa159d938b3cab4bf
** Installation size: 4.09 GB	
evices	
Intel® Arria® II device support	
Download arria_lite-22.1std.1.917.qdz	Size: 499.1 MB SHA1: e9d3ce3a3a8581576f1a33c63a306c922fdd617d
** Installation size: 0.52 GB	
Intel® Cyclone® IV device support	
Download cyclone-22.1std.1.917.qdz	Size: 465.8 MB v SHA1: cbbfc3ffdcee8a2535b9e129bd7444f3fa18b71f
** Installation size: 0.50 GB	
Intel® Cyclone® 10 LP device support	
Download cyclone10lp-22.1std.1.917.qdz	Size: 265.5 MB SHA1: a26747672b0e8f48c0e6691760760b3ce60cba42
** Installation size: 0.29 GB	
Intel® Cyclone® V device support	
Download cyclonev-22.1std.1.917.qdz	Size: 1.3 GB v SHA1: 379e51b9e908cd43b9515f93f42f2a230a405a60
** Installation size: 1.40 GB	
Intel® MAX® II, Intel® MAX® V device support	
Download max-22.1std.1.917.qdz	Size: 11.4 MB
** Installation size: 0.01 GB	
Intel® MAX® 10 FPGA device support	
Download max10-22.1std.1.917.qdz	Size: 286.4 MB SHA1: c3a42e7dedae4ffad45320062b4492818df74f5e
Download max10-22.1std.1.917.qdz	Size: 286.4 MB SHA1: c3a42e7dedae4ffad45320062b4492818df74f5e

University of Florida Department of Electrical & Computer Engineering Page 19/24

3. Open a terminal and navigate to your Downloads folder. We can then run the Questa installer by issuing the following commands. Make sure that you do not run the Questa installer as root!

```
chmod +x QuestaSetup-22.1std.1.917-linux.run
./QuestaSetup-22.1std.1.917-linux.run
```

- 4. When prompted to select which version of Questa you want to install, choose Questa Intel FPGA Starter Edition
 - a) Leave all default options in the installer and select Next each time it is necessary.

Installing Questa - Intel FPGA Edition or Starter Editio	n 2021.2 (Quartus Prime 22.1s 🗕 🗙
Select Questa edition you like to install	intel.
Questa - Intel FPGA Starter Edition	
O Questa - Intel FPGA Edition	
This software requires a license. Please sign up for free Early	y Access license at
https://www.intel.com/content/www/us/en/software/progra	mmable/quartus-prime/whats-new.html
VMware InstallBuilder	
Animal C Harding and Cl	<pre>< Back Next > Cancel</pre>

5. To allow easy access to your Questa installation, create a text file called questa.desktop using the text editor of your choice and copy the following contents into it. Make sure to change YOURUSERNAME to the username of the account that you installed Questa for.

```
[Desktop Entry]
Version=1.0
Type=Application
Terminal=true
Exec=/home/YOURUSERNAME/intelFPGA/22.1std/questa_fse/bin/vsim
Name=Questa
```

- a) If your distribution supports desktop icons, you can copy this file to your Desktop folder and it will work as a desktop shortcut
- b) To add a Quartus shortcut to your Apps menu, copy this file to ~/.local/share/applications, creating that folder if necessary. This was tested for GNOME.

University of Florida Department of Electrical & Computer Engineering Page 20/24

EEL 3701 Revision **0 Quartus Installation Instructions** (Last Updated for Quartus v22.1.1)

- 6. To prepare for acquiring a Questa License, we must find the hardware ID number of your network card. Intel uses this number to verify that your computer is licensed to use Questa.
 - a) Open a terminal and run the command ip link. (without the period)
 - b) Look for an adapter named eth0 or enp0sXX. Under that entry, look for a line starting with link/XXXX followed by a series of digits and letters. This series of digits and letters (without colons) is your network card ID. Save this number for use when requesting your Questa License. For example, the ID number in the below screenshot is 001d098ebed3.

Л	matthew@matthew-potato: ~	
<pre>matthew@matthew-potato:~\$ ip 1: lo: <loopback,up,lower_up 00:00:00:00="" 00:1d:09:8e:b<="" 1000="" 2:="" <broadcast,multi="" default="" enp0s25:="" ether="" gl="" group="" link="" loopback="" ode="" pre="" qlen=""></loopback,up,lower_up></pre>	link > mtu 65536 qdisc noqueue st 0:00:00 brd 00:00:00:00:00:0 CAST,UP,LOWER_UP> mtu 1500 c en 1000 e:d3 brd ff:ff:ff:ff:ff:ff:ff	tate UNKNOWN mode DEFAULT 90 qdisc fq_codel state UP m
matthew@matthew-potato:~\$		

- 7. Follow the instructions in <u>Obtaining a Questa License</u>
- 8. Once you have obtained your Questa license, copy it to a safe folder where it won't accidentally get deleted. This tutorial assumes that you create the folder ~/intelFPGA/licenses and copy your license file there.
- 9. We need to set the LM_LICENSE_FILE environment variable globally so that Questa knows where to find the license file. To do this, create /etc/environment.d/90quartus-license.conf and populate it with the following text. Make sure to use the username you installed Questa for and the correct name of your license file. You will need superuser privileges to create this file.

LM_LICENSE_FILE=/home/YOURUSERNAME/intelFPGA/licenses/LR-XXXXXX_License.dat

10. Restart your computer so that the changed environment variable takes effect.

University of Florida Department of Electrical & Computer Engineering Page 21/24

EEL 3701 Revision **0 Quartus Installation Instructions** (Last Updated for Quartus v22.1.1)

- 11. By default, Questa aggressively optimizes your circuit designs so much that the outputs of your simulations will not be visible in the Quartus VWF viewer. To fix this, we need to replace the VWF viewer's library file with a modified version that sets Questa to not optimize your designs while simulating. Download **libedt_wedtq.so** and copy it into ~/intelFPGA_lite/22.lstd/quartus/linux64. Make sure to replace the older version of this file in the destination.
- 12. Open Quartus and navigate to Tools->Options. In the Options window, select EDA Tool Options in the left panel. In the text boxes next to the Questa and Questa Intel labels, insert the path to Questa's bin folder. The default install location uses the path /home/YOURUSERNAME/intelFPGA/22.1std/questa_fse/bin. Click OK to save the simulator settings. Now you will be able to use Questa from the Quartus VWF editor.



The Questa GUI does work for Linux (unlike Modelsim), but using Questa from its GUI (such as for Digital Design) leads to the over-aggressive optimization that can break some simulations. To disable this, go to Simulation->Design Optimization->Visibility, and click the radio button next to Apply full visibility to all modules.

Appendices

Obtaining a Questa License

Questa is the newest simulator provided by Intel. It supports modern hardware and uses modern dependencies, but it unfortunately requires a free license to use. Getting a Questa license is a somewhat involved process. Only follow these instructions if you are installing Questa. If you are using ModelSim as your simulator you do not need to get a license.

- 1. Using Google Chrome or Chromium, navigate to the <u>Intel Self-Service Licensing Center</u>. The website will not allow you to get a license if you use Firefox. Click Enroll for Intel® FPGA Self Service Licensing Center (SSLC) and create an account. I would recommend signing up using your UF email. The enrollment process may require you to download the Microsoft Authenticator app onto your phone for two-factor authentication. I have not found a way to circumvent this requirement.
- 2. Once you have activated your account, go to the <u>Home Page for the Self-Service Licensing Center</u> and click on Sign up for Evaluation or Free Licenses.



3. Click the radio button next to Questa-Intel FPGA Starter Edition. Click the pencil icon next to Questa-Intel FPGA Starter Edition in the # of Seats column and type in 1. Leave all other rows in their default values. You must do these steps in exactly this order or the page will automatically refresh. See the below screenshot. Check the license agreement checkboxes below the table and click Get License.

	Intel® FPGA Se	elf-Service Licensing Center		
Home Licenses 🗸	Computers and License Files 🗸 Admins 🗸	Sign up for Evaluation or Free Licenses Report	rts Help 🗸	
Product ~	# of Seats	✓ Maintenance expiration	✓ License expiration	
Intel® FPGA IP IP-NIOSVG		A 2024-05-30		
Intel® Quartus® II Software SW-QUARTIIS-WE-EIX	1	2024-05-30		
Questa*-Intel® FPGA Starter Edition SW-QUESTA	1	A 2024-05-30		
Intel® FPGA MAXPLUS2WEB		✓ 2024-05-30		
O Intel® FPGA IP PLS-WEB		\$ 2024-05-30		
Intel® FPGA EVALUATION-LIC		A 2023-08-30	2023-08-28	
Intel® FPGA IP IP-NIOSVM		\$ 2024-05-30		
have read and agree to the terms of use of this license as listed below :enance for this license is valid for 12 months from the date you sign up fo heak this hox if you don't want Intel to contact you for feedback. Your fee	or this license. Terms of Use dback helps us improve the product.			
				Get Lic

4. In the window that appears, click New Computer under Create a New Computer

Create a New Computer	
+New computer	
Assign an Existing Computer	
Enter Computer Name/Primary Computer ID	
Enter Computer Name/Primary Computer ID	0

5. Give the computer a memorable name. Under License Type, select Fixed. This creates a single-user license tied to your individual computer. Under Computer Type, select NIC ID. This will tell Intel that your computer will be identified by its network card. Under Primary Computer ID, type in the hardware ID of your network card (found earlier in your operating system's Questa installation tutorial). The hardware ID should only include hexadecimal digits (0-9, a-f). Make sure to remove any spaces, dashes, or colons in the number. The form should look like the below screenshot, but with a different Computer Name and Primary Computer ID. Finally, click Generate License.

Computer Name	* Computer Type
Matthew's Desktop	NIC ID 💌
License Type 🚯	How to determine Computer Type and hardware information?
FIXED	Primary Computer ID
ompanion Computer ID 1 🚯	001d098ebed3
· · ·	Companion Computer ID 2
Primary Admin	
🖽 Matthew Hershfield	

6. Look for an email from authorization@intel.com sent to the address you used to create your Intel account. A license file named LR-XXXXX_License.dat should be attached to the email. Download that file and return to the Questa Installation Tutorial.

University of Florida Department of Electrical & Computer Engineering Page 24/24 EEL 3701 Revision 0 Quartus Installation Instructions (Last Updated for Quartus v22.1.1)

Sources

- https://stackoverflow.com/questions/18704913/unable-to-lock-chain-insufficient-port-permissions
- <u>https://wiki.archlinux.org/title/Intel_Quartus_Prime</u>
- https://cdrdv2-public.intel.com/666293/quartus install-683472-666293.pdf
- https://web.archive.org/web/20220614084754/https://ecen3350.rocks/static/usb-blaster.pdf