

COMPUTING RESOURCES FOR MATH & STATS GRADUATE STUDENTS

11/18/13 - This is a work in progress. An updated version will be maintained and posted here. If you find any typos or have any information that you think should be added, please email Ava at avamauro@bu.edu.

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1 Opening a command line shell (a.k.a. text terminal, terminal window . . .)

- **Terminal** (for Mac): Open Application folder → Utilities folder → Terminal
 - **Putty** (for Windows): Info on how to download and set up Putty is available on the Graduate Student Resources page
<http://www.bu.edu/math/graduate-programs/graduate-student-resources/#software%20and%20tech>
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2 Logging into servers

- ***** (math department server): in the terminal window type the command
`ssh -Y yourBUusername@ServerName.bu.edu`
 - BU ACS and ACS-Linux servers: `ssh -Y yourBUusername@acs.bu.edu`
or `ssh -Y yourBUusername@acs-linux.bu.edu`
 - To log out of a server, type the command `logout`
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3 Some UNIX commands

A good place to start: <http://mally.stanford.edu/~sr/computing/basic-unix.html>

Longer list of commands: <http://www.math.harvard.edu/computing/unix/unixcommands.html>

- `man CommandName` - show manual information on command *CommandName*
- type q to exit man page
- **Navigating folders/files**
The tab key can be used to autocomplete after typing the beginning of a command, file name, or directory name.
 - `pwd` - print working directory - tells you what folder you're in
 - `ls` - list files in the current directory
 - `ls DirectoryName` - list files in directory *DirectoryName*
 - `more FileName` - show the contents of a file *FileName*
 - `cd` - change to your home directory
 - `cd ..` - change to directory one level up
 - `cd DirectoryName` - change to *DirectoryName*
 - * (asterisk) - metacharacter to take the place of any string of characters in a file name except an initial dot. e.g. `ls *.tex` lists all files ending with `.tex` in the current directory
 - <http://www.itcs.umich.edu/itcsdocs/s4148/> - Info on creating, copying, renaming, and removing files and folders - `mkdir`, `cp`, `mv`, `rm`
 - transferring files between machines - `scp`, `svn`, `git`, WinSCP
- **Checking memory usage and processes that are running**
 - `du -sh` - show your total disk space usage in a human-readable number
 - `df -h` - show file system disk space usage in human-readable form
 - `top` - show info about processes that are running - type q to exit
 - `uptime` - show current time, how long the system has been running, how many users are currently logged on, and the system load averages for the past 1, 5, and 15 minutes.
 - `ps -u yourBUusername` - list all processes that you're running and their process ID numbers

`kill PID` - terminate process with process ID number *PID*
`nice` - run a command at low priority
`ctrl-c` - stop current process
`ctrl-z` - suspend current process (so that you can type in the command window, does not stop the process)
`fg` - bring suspended process to the foreground
`bg` - put suspended process into the background

4 Software

GUI = Graphical User Interface, **CLI** = Command Line Interface

- **X11** (X Window System) - windowing system that provides the basic framework for running a GUI
 - X-Win32 (for Windows) - Free for BU students to download from <http://www.bu.edu/tech/support/desktop/distribution/xwindows/xwin32/>
 - Cygwin/X (for Windows) - Free to download from <http://x.cygwin.com/>
 - XQuartz (for Mac) - Free to download from <http://xquartz.macosforge.org/>
 - Mac OS X versions 10.5 through 10.7 include a pre-installed version of X11.

4.1 Mathematics and Statistics software

- **Matlab** - numerical computing environment and programming language
 - Free to BU students with signature from a faculty member. Print and complete the Media Loan Application from <http://www.bu.edu/tech/support/desktop/distribution/mathsci/matlab/installing-matlab-locally> and bring to the Mugar Library reserve desk to borrow installations CDs. Using the installed software when off-campus requires connecting to the campus network through VPN: <http://www.bu.edu/tech/support/remote/vpn/>
 - Available on dept server and ACS-Linux - type `matlab` to open GUI, `matlab -nodisplay` to open CLI.
- **Mathematica** - general purpose computer algebra system
 - Free for BU students to download from <http://www.bu.edu/tech/support/desktop/distribution/mathsci/mathematica/student/>
 - Available on dept server and ACS-Linux - type `mathematica` to open GUI, `math` to open CLI.
 - Wolfram Alpha <http://www.wolframalpha.com/>
- **Maple** - general purpose computer algebra system
 - Available on dept server and ACS-Linux - type `xmaple` to open GUI, `maple` to open CLI.
- **R** - statistical software and programming language
 - Available on dept server and ACS-Linux - type `R` to open CLI.
 - Free to download from <http://www.r-project.org/>

- **SAS** (Statistical Analysis System) - statistical package for data management, statistical analysis, and graphics
 - Available on ACS-Linux - type `sas` to open GUI, type `sas -nodms` to open CLI.
- **JMP** - statistical analysis software
 - Free to BU students <https://www.bu.edu/software/stats/jmp/>
- Other Statistics programs - **SPSS, Stata, S+**
- **Pari/GP** - computer algebra system, specialized for number theory
 - Available on dept server - type `gp` to open CLI.
 - Free to download from <http://pari.math.u-bordeaux.fr/>
- **Macaulay2** - computer algebra system, specialized for algebraic geometry and commutative algebra
 - Free to download from <http://www.math.uiuc.edu/Macaulay2/>
- **GAP** (Groups, Algorithms, Programming) - computer algebra system, specialized for computational discrete algebra, group theory
 - Available on dept server - type `gap` to open CLI.
 - Free to download from <http://www.gap-system.org/>
- **Sage** - general purpose mathematics and statistics software system
 - ★ combines many existing programs/language (e.g. Python programming language, R for statistics, Pari/GP for number theory)
 - Available on dept server - type `sage` to open CLI.
 - Free to download or use online at <http://www.sagemath.org/>
- **AUTO** - software for continuation and bifurcation problems in ordinary differential equations
 - Available on dept server - software is located in the directory `/local/local1/linux-software/auto/97`
 - Free to download from <http://indy.cs.concordia.ca/auto/>
The download includes documentation with many demos and examples.
 - Software for the demos is also available on dept server in `/local/local1/linux-software/auto/97/demos`
- **XPP/XPPAut** - numerical software for dynamical systems and differential equations
 - Includes AUTO
 - Free to download from <http://www.math.pitt.edu/~bard/xpp/xpp.html>

4.2 Other software

- **Text editors** available on dept server: `xemacs`, `emacs`, `kedit`, `gedit`, `nano`, `pico`, `vi`
 - To open a file in a text editor, type the name of the editor followed by the name of the file e.g., `kedit FileName`
If a file named *FileName* does not already exist, this will create a blank file with that name.

- **McAfee Anti-virus** - Free for BU students to download from <http://www.bu.edu/tech/support/desktop/removal/security/mcafee/>
 - List of software available in the Mugar Library computer lab: <http://www.bu.edu/common/technology/software/>
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5 BU IS&T online resources and live tutorials

<http://www.bu.edu/tech/about/research/training/> includes:

- Software Help Pages
 - In-person Tutorials
 - on Research Computing Basics, Programming Languages, Mathematics and Statistics Computing, High Performance Computing, and Visualization
 - Online Tutorials
 - Archive of presentations from workshops, seminars, or other events
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6 BU Scientific Computing and Visualization (SCV)

<http://www.bu.edu/tech/about/research/scv/>

If you need to run a job that requires more memory than is available on your office computer or the dept server, BU has:

- the Katana Cluster - a Linux Cluster of 77 nodes with 384 Intel and AMD processors
- IBM Blue Gene - a 1024-node massively parallel computing system

There is also a Computer Graphics Lab with a Deep Vision Display Wall and several high performance Linux and Windows workstations.

7 Setting up your webpage

As a grad student in the Dept. of Mathematics & Statistics, you have a webpage available at

<http://math.bu.edu/people/yourBUusername>

- To access the directory containing your webpage, log in to dept server and type the command
`cd /usr/local/software/other/www/people/yourBUusername`
- The directory contains a file called `index.html`. This file contains the html code for your webpage.
- You can add more files to this directory. A file called `filename.html` will correspond to the url `http://math.bu.edu/people/yourBUusername/filename.html`. You can also add non-html files, e.g. `filename.pdf` for `http://math.bu.edu/people/yourBUusername/filename.pdf`.

To make a new page accessible to the public, you need to change the permissions on the corresponding file. The command `chmod o+r filename` will make the page readable to everyone, and `chmod o-r filename` will make it unreadable.

- Ask Allyson to have a link to your webpage added to your name in the list of grad students on the department website.
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8 BU and Math email accounts

- To have your math email account set up (*yourBUusername*@math.bu.edu), ask Tim Kohl.
 - Email forwarding can also be set up.
 - Accessing BU email through phones/mobile devices:
<http://www.bu.edu/tech/comm/email/acs/mobile-devices/>
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9 Faculty Link, Blackboard

- If you are a TF, the professor can give you access to the class lists on Faculty Link and Blackboard. Most professors don't do this automatically - you usually have to ask. The class lists on Faculty Link include pictures of the students, so this is helpful if you want to learn their names.
 - There are training sessions and online help material for Blackboard Learn:
<http://www.bu.edu/tech/teaching/lms/blackboard/>
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10 Media Support Services for your classroom

On the Media Support Services website <http://www.bu.edu/tech/teaching/classroom/>, you can

- request that Media Support Services send someone to your classroom at a specified time to help with audio/visual equipment (e.g. computer display projectors)
 - request equipment
 - search for a classroom with particular equipment
 - look up the equipment available in a particular classroom.
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11 \LaTeX - a typesetting language and document preparation system

Several short and long guides to LaTeX are available on the Graduate Student Resources page <http://www.bu.edu/math/graduate-programs/graduate-student-resources/#latex>

- Useful software: **MiKTeX** (for Windows), **TeXshop** (for Mac), **TeXworks**
- **LaTeX Equation Editor** (for Windows) <http://latexeqedit.sourceforge.net>, **LaTeXiT** (for Mac)
- for typesetting short LaTeX strings (e.g. equations). The resulting image can then be dragged/copied into other applications (TextEdit, graphics editors, ...).

- **Detexify** - LaTeX handwritten symbol recognition - an app and online tool for looking up LaTeX commands for symbols <http://detexify.kirelabs.org>
 - Standard LaTeX document classes: article, proc, minimal, report, book, slides
 - There are many other LaTeX document classes: beamer (for presentations or posters), res (for resumes or CVs), memoir, letter, amsart, amsproc, amsbook, elsarticle ...
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12 Creating and Editing Figures

Free programs:

- **xfig** - Drawing tool (vector graphics editor) for creating figures. <http://www.xfig.org>
 - **gimp** - GNU Image Manipulation Program for image retouching and editing. <http://www.gimp.org>
 - **laprint.m** - MATLAB function to convert a MATLAB figure into an eps-file and a tex-file for inclusion in LaTeX documents. <http://www.uni-kassel.de/fb16/rat/matlab/laprint>
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13 Some other useful websites/services

- **Educreations** - App for recording your voice and handwriting on a “whiteboard” to create videos that you can posted online for your students. <http://www.educreations.com>
 - **arXiv.org** - Online repository for preprints of papers in Mathematics, Statistics, Computer Science, Physics, Quantitative Biology, and Quantitative Finance. <http://arxiv.org>
 - **Dropbox** - Online file backup and sharing service. You can create a Dropbox folder on all your computers, tablet, phone, etc. Files are automatically synchronized on all devices where you have installed Dropbox, and are also available by logging in to the Dropbox website. <https://www.dropbox.com>
 - **Evernote** - Software and services for notetaking and storing files. <http://evernote.com>
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14 Information Security and Privacy

- <http://www.bu.edu/infosec/isaw/blasts/> - Useful tips about keeping your info safe on your computer, phone, etc.
- <http://www.bu.edu/infosec/> - Security alerts and lots of other info
- <http://www.bu.edu/tech/support/desktop/removal/security/> - Anti-virus and anti-spyware software