Lesson 24

INSTALLING GAP SOFTWARE

The acronym "GAP" stands for "Groups, Algorithms, and Programming," and it's a free software program that can be used in the study of finite groups as well as other aspects of abstract algebra. The best thing about it is that it is free and it is very useful. The worst thing is that the documentation is not always very clear. Consequently, in the second part of this lesson, "How to Use GAP," I give several examples of the coding that must be entered in order to do several basic things in group theory such as find the size and elements of a group, find the center of a group, find the Sylow subgroups of a group, and more. In this first part, though, I just try to show you how to download and install GAP software on a Windows machine.

You can begin by going to http://www.gap-system.org/, and this is what you will see.



Next, you click on the "Downloads" link on the left, find file that fits your operating system, and launch it once it's downloaded.

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← → C 🗋 www.gap-system.org/Releases/index.html				
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Find us on GitHub	GAP 4.8.4			
<u>Sitemap</u>	This release replaces <u>GAP 4.8.3</u> (see the overview of changes between GAP 4.8.4 and GAP 4.8.3 <u>here</u>).			
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Start Downloads GAP 4.8.3 (Jane 2016) GAP 4.8.3 (March 2016) GAP 4.8.2 (February 2016) GAP 4.7.9 (Aventher 2015) GAP 4.7.9 (Aventher 2015)	Download one of the archives below, unpack it and run ./configure; make in the unpacked directory. Then change to the pkg subdirectory and call/bin/BuildPackages.sh to run the script which will build most of the packages that require compilation (provided sufficiently many bbraries, headers and tools are available). For further details, see <u>here</u> . Expert users can find the description of all installation options in the <u>INSTALL</u> file. <u>gap4r8p4_2016_06_04-12_41.tar.gz</u> 309 MB md5: 0f53315a06293c47b10db986ebf09559 gap4r8p4_2016_06_04-12_41.tar.gz 256 MB md5: 0f5542Pf5847D13394825549a9743ed			
<u>GAP 4.7.7 (February 2015)</u> GAP 4.7.6 (November 2014) GAP 4.7.5 (May 2014)	<u>gap4r8p4 2016_06_04-12_41.zip</u> 330 MB md5: a7c6e7ceaee01d5666666eb4aaa36d81 You may also consider one of the alternative distributions. Note, however, that these are updated independently and may not yet provide the			
<u>GAP 4.7.4 (February 2014)</u> <u>GAP 4.7.3 (February 2014)</u> <u>GAP 4.7.2 (December 2013)</u>	latest GAP release. Windows			
GAP 46.5 (July 2013) GAP 46.4 (May 2013) GAP 46.3 (Merch 2013) GAP 46.2 (February 2013) GAP 45.7 (December 2012) GAP 45.6 (September 2012)	We strongly recommend to use the .exe installer which contains binaries for GAP and some packages and provides the standard installation procedure. Note that the path to the GAP directory should not contain spaces. For example, you may install it in C:\gap4r8 (default), D:\gap4r8p3 or C:\Math\GAP\gap4r8, but you must not install it in a directory named like C:\Program files\gap4r8 or C:\Users\alice\My Documents\gap4r8 etc.			
GAP 4.5.5 (July 2012) GAP 4.8.4 - Google	gap4r8p4_2016_06_04-12_41.exe 412 MB md5: c6042b63dbaa2e7386985b2286c6054f ✓ C ☑ Document1-Microsof ☑ I @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @			

After GAP has been installed, it will appear in your list of programs as follows if you have installed the Windows version.

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When you launch it, it will take a minute or so to load the library and packages. When done, though, this is what you will see.



The GAP program, of course, is driven by syntax which means all the commands must be entered in just the right way. For programs like this, I've found that the best way to learn it is to have good examples you can copy, and that's what I present in the "How to Use GAP" file that follows this one. There is also online documentation, but it is not always easy to find the examples you need or to follow the ones you find. To get to the documentation, click on the link on the left that says, "Documentation."



From this page, the links to "Tutorial" and "Reference Manual" under "Manuals" are both pretty good. The manual "Abstract Algebra with GAP" is also excellent, and so I've included a link to it on my webpage right after my "How to Use GAP" tutorial. And anything else you need to know, you can probably figure out from perusing the webpage for GAP and from doing Internet searches, and so enjoy!

And in closing, here is a quick example of me using GAP to find the group generated by a couple of permutations and to also find the size of the group and the elements of the group.

```
gap> a:=(1,2,3);
(1,2,3)
gap> b:=(2,3);
(2,3)
gap> g:=Group(a,b);
Group([ (1,2,3), (2,3) ])
gap> Size(g);
6
gap> Elements(g);
[ (), (2,3), (1,2), (1,2,3), (1,3,2), (1,3) ]
gap>
```