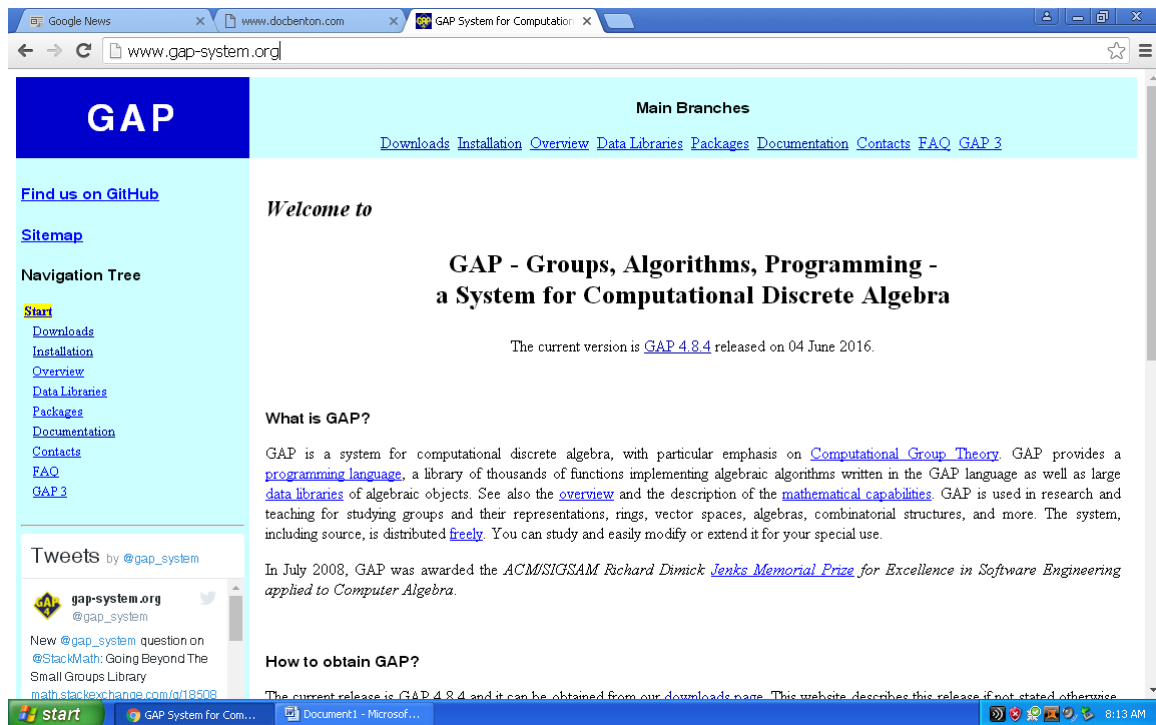


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INSTALLING GAP SOFTWARE

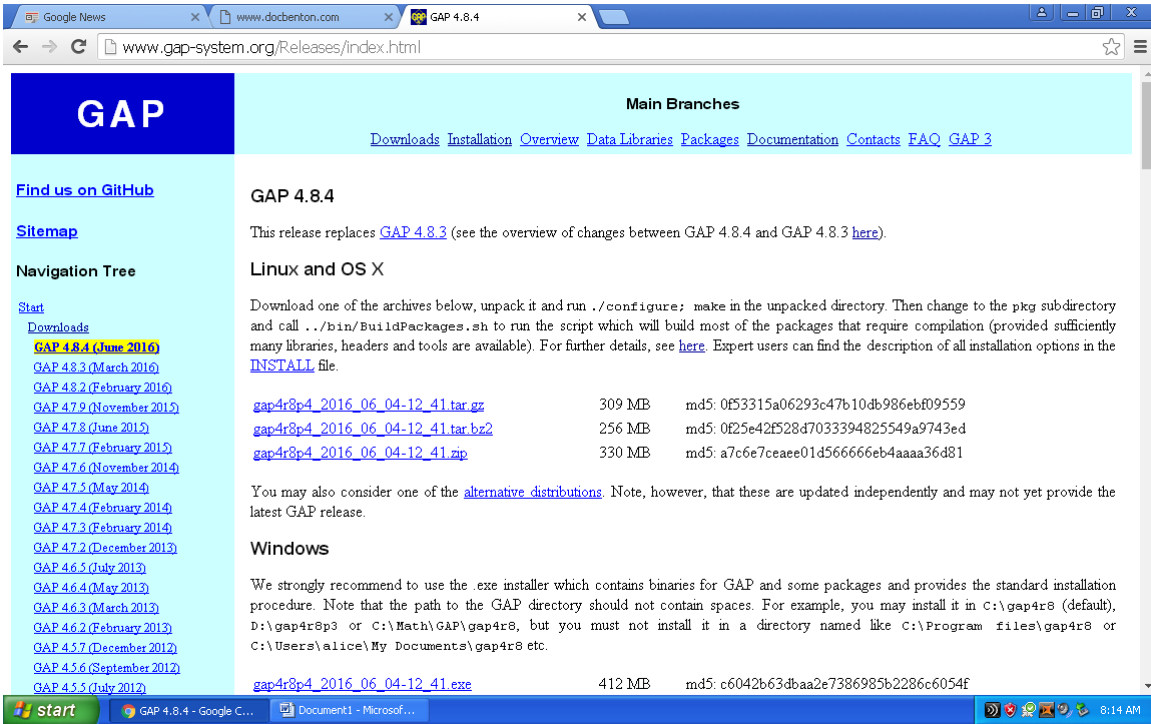
The acronym “GAP” stands for “Groups, Algorithms, and Programming,” and it’s a free software program that can be used in the study of finite groups as well as other aspects of abstract algebra. The best thing about it is that it is free and it is very useful. The worst thing is that the documentation 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.

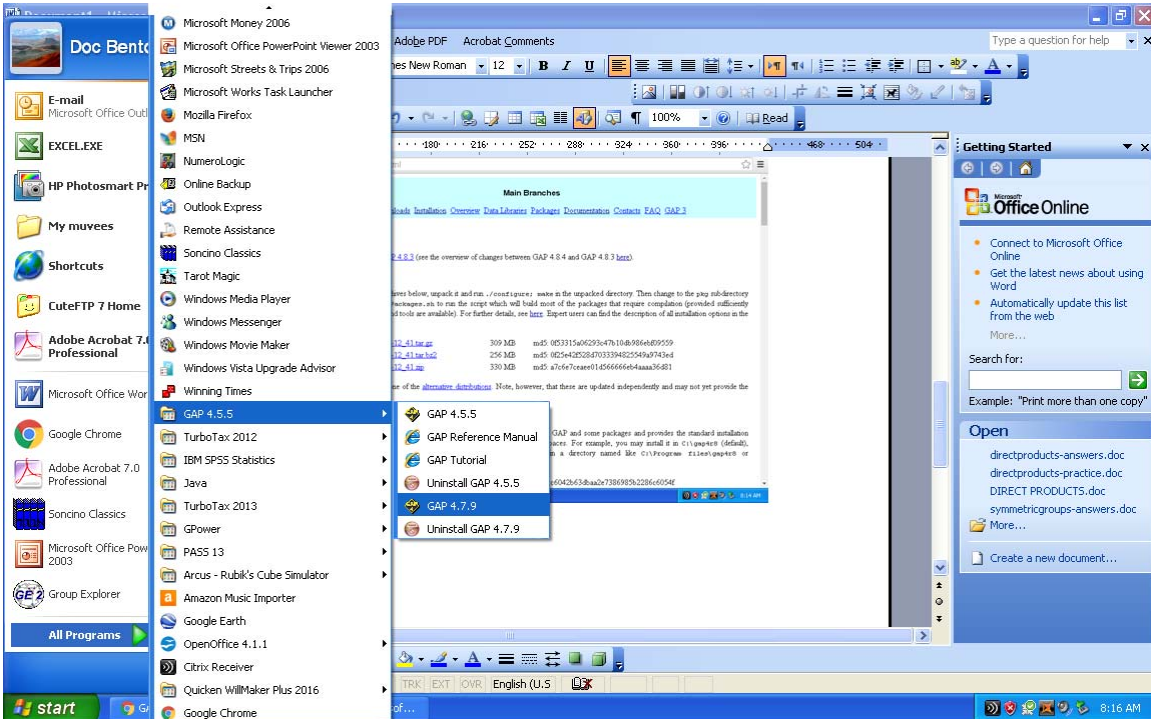


Next, you click on the “Downloads” link on the left, find file that fits your operating system, and launch it once it’s downloaded.

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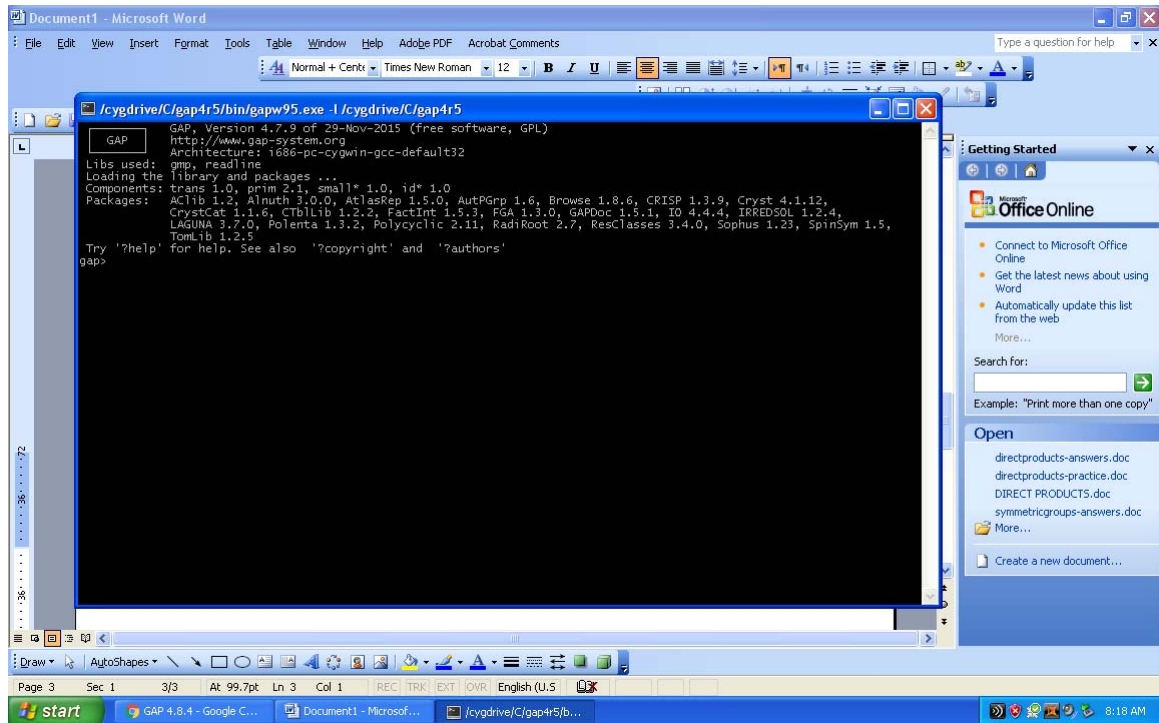


After GAP has been installed, it will appear in your list of programs as follows if you have installed the Windows version.



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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.



```
Document1 - Microsoft Word
: File Edit View Insert Format Tools Table Window Help Adobe PDF Acrobat Comments
Type a question for help

/cygdrive/C/gap4r5/bin/gapw95.exe -l /cygdrive/C/gap4r5

GAP
GAP, Version 4.7.9 of 29-Nov-2015 (free software, GPL)
http://www.gap-system.org
Architecture: i686-pc-cygwin-gcc-default32
Libs used: gmp, readline
Loading the library and packages ...
Components: trans 1.0, prim 2.1, small* 1.0, id* 1.0
Packages: AClib 1.2, Alnuth 3.0.0, AtlasRep 1.5.0, AutPGrp 1.6, Browse 1.8.6, CRISP 1.3.9, Cryst 4.1.12,
CrysCat 1.1.6, CTBlib 1.2.2, FacInt 1.5.3, FGA 1.3.0, GAPDoc 1.5.1, IO 4.4.4, TRRESOL 1.2.4,
LAGUNA 3.7.0, Polenta 1.3.2, Polycyclic 2.11, RadRoot 2.7, ResClasses 3.4.0, Sophus 1.23, SpinSym 1.5,
TomLib 1.2.5
Try '?help' for help. See also '?copyright' and '?authors'
gap>
```

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."

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The screenshot shows a web browser window with the URL www.gap-system.org/Doc/doc.html. The page features a blue header with the GAP logo and a navigation menu. The main content area is titled "Documentation" and contains several sections: "Search Facilities", "Manuals", "Learning GAP", and "Teaching Material". The "Manuals" section includes links to a "Tutorial" and a "Reference Manual". The "Learning GAP" section mentions a "Forum Archive". The "Teaching Material" section states that GAP has been used in several places to support the teaching of a variety of courses.

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>
```