

Oscar Software Modules

Below are instructions for software modules available on the Oscar clutter.

- [Currently Available Modules](#)
- [Oscar: Sage](#)
- [Oscar: MATLAB](#)
- [Oscar: Mathematica](#)
- [Oscar: R](#)
- [Oscar: Macaulay 2](#)
- [Oscar: Magma](#)

Currently Available Modules

If you require a software package that is not currently available on the Oscar cluster, please [contact ICERM's IT staff](#) and we will work with CCV to get the software installed.

This list is current as of May 6, 2025. Please scroll across the code snippet to see the full list. For the most up-to-date list of software modules, log into your Oscar account and run the command
`module avail`.

Note: D is the default module.

abaqus-container/2021-akaeexs	filezilla/3.49.1-	
epfjuus	mafft/7.505-iuicuv	git/2023-04-04-
grwuvvgg		
abaqus/2017-q4ghhm5	flashpca/2.0-	
zr2wflq	magma-usyd/V2.28-8-p3zylpg	qmcpack-
mpi/3.16.0s-qp2hymx		
abaqus/2021.1-i675dvw	freebayes/1.3.6-	
v7rppcd	magma/2.7.1-cpueyjj	qscintilla/2.11.6-
dq7zlcq		
abaqus/2024-h5273a3	(D) freeglut/3.2.2-	
76qqoqn	maple/22-cp2uld4	qt/5.15.9-fb7mjex
abaqus/2024-ir-a4m5ld5	freesurfer/7.3.2-	
zop5n6m	mark/2018.07.08-43snzfu	qualimap/2.2.1-
mybpdoi		
abaqus/2024-mbessa-ceayfu0	freesurfer/8.0.0-jotmypd	
(D) materialstudio/2024s-gbc3dg6	quantum-espresso-mpi/7.1-gits-v4bxgtv	
abaqus/2024.1-7pcdqhp	fsl/6.0.7.7s-	
bul4mby	mathematica/13.2.0-n4i6yua	quantum-
espresso-mpi/7.1s-ia43pjk		
admixture/1.3.0-onwaqrp	fv/5.5.2-	
g2ibb5x	matlab/R2019a-rjyk3ws	quantum-
espresso-mpi/7.3s-kydgjwo	(D)	
afni/23.3.07s-zm43m3u	fzf/0.45.0-	
pdwl7a4	matlab/R2023a-xd6f7ph	(D) r/4.0.0-
p7gxu4e		
afni/24.2.01s-kstpoqt	(D) gatk/4.3.0.0-	
234wqft	matlab/R2024b-ipaztju	r/4.0.3-pvf2znb

anaconda/2023.09-0-7nso27y	gaussian/09_v1-	
u6klkps	maven/3.8.4-w3zgh4v	r/4.1.0-bfjsw5
angsd/0.935-cbhuwc7	gaussian/09-D01_v2-	
tw73726	mercurial/5.8-vly6btb	r/4.2.2-z6qdiis
ant/1.10.13-alpqj4j	gaussian/09-D01-TEST_v3-	
vv6ar67	mesa/22.1.6-yi2tztm	r/4.3.1-lmofgb4
ants/2.4.3-75npyop	gaussian/16-C01-bb2r2gh	
(D) meson/1.6.0-eipcwzq	r/4.4.0-yyccstj	
aria2/1.36.0-lsb7zcs	gaussview/v05-	
mkdyw6j	metis/5.1.0-7qoahod	r/4.4.2-
re5rjx3	(D)	
arm-forge/22.1.3-zq7lvdq	gcc/6.5.0-	
lwshmx	miniconda3/23.11.0s-odstpk5	raisd/2.9-
svyic22		
armadillo/12.2.0-4clpczv	gcc/10.1.0-	
mojgbnp	miniforge/23.11.0-0s-hwmjdtj	rclone/1.62.2-
o4lkrv6		
atom/1.19.3-ty5sdsn	gcc/13.1.0-nvrtbp3	
(D) minimap2/2.14-33hmvx2	readline/6.3-rnqps2	
autoconf/2.69-p4rpdx2	gcm/2.4.1-	
lfqoarh	molden/6.7-isryqwj	readline/8.2-
5xbuyjt	(D)	
autoconf/2.71-opdgqng	(D) gdal/3.7.0-	
4p4onmf	molden/7.3-kytvh3m	(D) root/6.28.04-
u7t5ax7		
avogadro2/1.99.0-5zl5qaw	gdal/3.10.3-4vc4f76	
(D) molpro-mpi/2023.2.0s-vyfv74n	rsem/1.3.3-5obucw6	
awscli/1.27.84-v22kngs	geeie/2.4-	
6vdnc4v	molpro-mpi/2024.3.1-mpipr-hwakoux	(D)
rstudio/2023.09.1-lsqy746		
bamtools/2.5.2-ki3mdef	geos/3.11.2-	
a6hfu6a	mpc/1.3.1-zbino7j	ruby/3.1.0-
gnoxsfm		
basilisk/2023.11.11s-x4isdvp	ghostscript/10.0.0-	
3atesdh	mpfr/4.2.0-n2tkxso	rust/1.73.0-647r2tw
bazel/6.1.1-vvtxktr	gimp/2.10.32-	
tlknk2n	mriconvert/2.1.0-oaq24fz	rust/1.81.0-
3qqoayc	(D)	
bbmap/39.01-jnnkpwk	git-lfs/3.3.0-	
laphnvj	microgl/2022.07.20-n3b7whc	sage-

container/10.3-avpqipf		
bcftools/1.13-76jesdj	git/2.44.0-	
6f7n7ni	micron/201909-3s2phrj	sage/9.5-
drpqjkh		
bcftools/1.16-ewu6fpe	(D) glew/2.2.0-	
plawm2j	msmc2/2.1.4-cuac55f	sage/10.3-
nntihfr	(D)	
bcl2fastq2/2.20.0.422-z3wh636	glm/0.9.9.8-	
m3s6sze	multiwfn/3.8_1208-qn65pif	salmon/1.9.0-
itdua6n		
beagle/5.4-e43mqsa	glpk/5.0-	
zifs7bb	mummer4/4.0.0rc1-4llgadq	
salmon/1.10.1-43ljn7g	(D)	
bedops/2.4.40-bjb2v2n	gmap-gsnap/2024-08-20-	
dur7jyc	muscle/3.8.1551-pys2b76	samtools/1.12-4v4uiz6
bedtools2/2.31.0-lsohc7s	gmp/6.2.1-	
qlaig4m	mysql/8.0.29-w7xdbde	
samtools/1.16.1-txuglks	(D)	
bismark/0.23.0-eoksupu	gnuplot/5.4.3-	
pdiiqy	nanoflann/1.4.3-u2l24dv	sas/9.4m8-f2f3xdp
blast-legacy/2.2.26-tcdku3a	go/1.17.1-	
f4mqosa	nbo/7.0-phausw3	schmutzi-
container/1.5.7-vsorpcq		
blast-plus/2.2.30-cyxldrt	go/1.20.3-	
xknmcqd	nccl/2.16.2-1-gjmrw5	schmutzi-
container/1.5.7-3imwf7h	(D)	
blat/37-ebfj5e6	go/1.23.3-d3wvs6z	
(D) ncdv/1.18.1-uofylp6	schrodinger/2023-4-h3kvbn3	
blender/4.4.0-446jdg	google-cloud-cli/456.0.0-	
3mtj4z6	nco/5.1.5-36hru5t	schrodinger/2024-1-yqi27-
m4qqm46	(D)	
boost/1.80.0-harukoy	gperf/3.1-	
56q4xf5	ncview/2.1.8-nxepxtw	scons/4.5.2-
housgyw		
bowtie/1.3.1-2kd7din	grace/5.1.25-	
duvo7rn	neovim/0.9.4-67stov2	seqkit/0.10.1-
qtiftw4		
bowtie2/2.4.2-xdquyzq	graphviz/8.0.1-	
75znavc	neovim/0.10.4-7b4mer5	(D) seqtk/1.3-kbdjwob
bowtie2/2.5.3-qgsc2u	(D) gsl/2.7.1-	

khmyfcy	netcdf-c/4.9.2-cfggqwi	
shapeit4/4.2.2-3us45un		
brotli/1.0.9-h22dril	guppy/6.0.1-	
wpaqayj	netcdf-c/4.9.2-4ozokng	(D) singular/4.4.0-
aeloppr		
bwa/0.7.17-lu4b4dj	guppy/6.1.2-wwwvdfu	
(D) netcdf-cxx4/4.3.1-6gcdg5s	skewer/0.2.2-nwhklgr	
bxh-xcede-tools-container/1.11.14-4sphv7n	gurobi/10.0.1-	
q7rc5dw	netcdf-fortran/4.6.0-kl27oji	slicer/5.4.0-
rb2kk4l		
cadence/IC06.18-calibre2022.2-ascb7dw	hdf5/1.12.2-	
s6aacp3	netcdf/4.9.2-ar77jpt	slim/4.0.1-
kymgtmu		
cadence/IC06.18.090-6famfci	hdf5/1.14.1-2-rdd6y6v	
(D) netlib-lapack/3.11.0-jdzmstx	slim/4.3-u22vcwu	(D)
cadence/IC23.10.000-ppql2n	(D) hisat2/2.2.1-	
gn4pb3l	netlogo/6.4.0-psm765m	spdlog/1.11.0-
qbi24my		
casa/6.6.0-20-py3.8-el7-dqvn5lw	homer/4.11.1-	
fpjs4l4	netpbm/10.73.43-m2jdopk	splash/2.1.4-
unrsfpj		
cdhit/4.8.1-bqmf4jf	hpcx-mpi/4.1.5rc2-mts-	
ukpby4i	ngc-jax/23.10-paxml-py3-zipbcif	spm/8-77b5myx
cellranger/arc-2.0.1-uamrhhu	hpcx-mpi/4.1.5rc2s-yflad4v	
(D) ngc-pytorch/24.03-py3-a6ptiby	spm/12_r7606-prcq7fg	(D)
cellranger/atac-2.0.0-m2tfcpk	htop/3.2.2-	
kqsjlaj	ngc-tensorflow/24.03-tf2-py3-lmnuwwg	
sratoolkit/3.0.0-u4jvgps		
cellranger/6.0.0-dbzt7r	(D) htlib/1.12-	
ecidzx4	ninja/1.11.1-k2aq3rl	stacks/2.65-
geg4r7a		
cfitsio/4.2.0-5grfqtu	htlib/1.17-zxcat2k	
(D) nlopt/2.7.1-fwj27pk	star/2.7.10b-fj6kao2	
cgal/5.4.1-64mikhl	idba/1.1.3-	
nrxiqtw	nnn/4.9-r7kawsv	stata/mp17-
v7a7uoo		
chrome/119.0.6045.159s-avadhvk	idemp/201706-	
a45gc3d	node-js/18.12.1-qkps4za	stata/mp18-
3wq5b4o	(D)	
cli11/2.3.2-pcucv7l	idl/8.9s-	

jocgnbh	nvhpc/23.3-xa4nyqi	stow/2.4.0-
y2q7tsn		
clustal-omega/1.2.4-mbj3dq5	igraph/0.7.1-	
wbiepb3	nvhpc/23.7-alnzdzw	stringtie/2.2.1-
7uti3ny		
cmake/3.6.1-il7bkvj	imagej/154-linux64-java8-	
jd6sflr	nvhpc/25.1-scv2ac	(D) sublime-text/4.4143-im3loi3
cmake/3.26.3-xi6h36u	(D)	imagemagick/7.1.1-3-
ex4k4u2	nvtop/3.0.1-7r22pjl	subread/2.0.2-5agghnd
cnvnator/0.4.1-w3bkqjf	inkscape/1.3s-	
gshcpwc	octopus-lunter/0.7.4-kkqrfv3	swig/4.1.1-
bq46cxl		
code-server/4.20.0-tcrmrcl	intel-oneapi-compilers/2023.1.0-	
a7fw7qt	ollama/0.3.14s-a3gonhs	synopsys/2023.12-df4a3ab
code-server/4.97.2-33bvsj5	(D)	intel-oneapi-mkl/2023.1.0-
xbcd2g3	ollama/0.5.12s-mjarasi	(D) synopsys/2024.09-
q3jwzot	(D)	
colordiff/1.0.21-ifskyqr	intltool/0.51.0-	
vanhjsr	openbabel/3.1.1-nay2mkb	tabix/2013-12-16-
d6qvxp7		
comsol/5.2-ufifhtv	iq-tree/2.1.3-	
gu64b4j	openblas/0.3.23-u6k5fey	tcl/8.6.12-
dziqp2l		
comsol/5.6_yqi27-jnspqto	iq-tree/2.3.6-fn5vscb	
(D) opencv/4.6.0s-5z4piup	tcsh/6.24.10-dtqo5ky	
comsol/6.3_yqi27-7yf67lt	(D)	iraf/2.17.1s-
2r7ypc5	openexr/3.1.5-6fapou6	tecplot/2022r1-
q5cg2zq		
conn/22a-nztrdv3	itk-snap-container/4.0.2-	
bychj73	openjdk/11.0.17_8-nw5ylv	tesseract/4.1.1-l2ejycz
connectome-workbench/1.5.0-t66riq	jags/4.3.1-	
4mvaxc3	openjdk/17.0.5_8-pq2e7ao	(D)
tesseract/5.3.3-vq3altr	(D)	
cppunit/1.14.0-h3hsjgu	jellyfish/2.2.7-	
dywzm7z	openjpeg/2.5.0-iyu5vwb	texlive/20220321-
pocclv		
crossrate-container/2016-27ofi4r	jo/1.9-	
ki7xc2u	openmpi/4.1.2-s5wtoqb	
texstudio/3.0.1-64vx064		
cuda/10.1.243-bxisbai	json-fortran/8.3.0-	

ehkzpjv	openmpi/4.1.4s-smqniuf	tk/8.6.11-uqpqlly
cuda/10.2.89-xnfjmr	jsoncpp/1.9.5-	
vhsa2iy	openmpi/4.1.5-kzuexje	tmux/3.3a-zyhjvvh
cuda/11.8.0-lpttyok	julia/1.9.3s-	
i3zndt3	openmpi/5.0.1s-6ti4ij7	tmux/3.5a-
kcjtgnd	(D)	
cuda/12.1.1-ebglvvq	julia/1.11.1s-kueea5s	
(D) openmpi/5.0.2s-mfj2kfp	(D) tn93/1.0.12-tcvbyl4	
cuda/12.2.0-4lgnkrh	kraken/1.1.1-	
e6r2aej	openslide/3.4.1-pzjb2kl	tree/2.1.0-
7tlhzo7		
cuda/12.3.0-r72aozf	lemon/1.3.1-	
jh3h4xt	openssl/1.1.1t-u2rkdft	trimal/1.4.1-
ace7du2		
cuda/12.4.0-piq32fy	(D) leptonica/1.81.0-	
pebiyok	or-tools/9.10-k4nov4d	trimgalore/0.6.6-
iwfrq4c		
cudnn/7.5.1.10-10.1-hv4e2lt	leveldb/1.23-	
f76iwfr	ovito/3.6.0-rile7ax	
trimgalore/0.6.9-hisz5xp	(D)	
cudnn/8.7.0.84-11.8-lg2dpd5	lftp/4.9.2-	
vimt4vf	p7zip/17.05-3xtimiz	
trimmomatic/0.39-w5jnhai		
cudnn/8.9.6.50-12-56zgdoa	libarchive/3.6.2-	
mnc5shn	pandoc/2.19.2-wawlx5m	udunits/2.2.28-
rycabdx		
cudnn/9.8.0.87-12-j5i4iki	(D) libbeef/Nov2020-	
xhrdwg5	pangolin/0.6-vwij3iv	usearch/11.0.667-
wx6utmj		
cufflinks/2.2.1-ogzw3z5	libdeflate/1.10-	
5yi7m3g	parallel/20220522-5ah2i5h	v8/3.14.5-aompxje
cutensor/1.5.0.3-gqkzath	libgd/2.2.4-	
2iyhgxa	paraview/5.9.0s-dgv24kr	vasp-mpi/5.4.4-
mdh3hpy		
datamash/1.8-ib4aakp	libgd/2.3.3-ubu4k2f	
(D) patchelf/0.17.2-aqmx4qb	vasp-mpi/5.4.4-wannier-cqhzfma	
dcm2niix/1.0.20220720-nwsidfo	libgeotiff/1.6.0-	
voueb6b	paup/4.0a168-cwt24ux	vasp-
mpi/6.3.2_avandewa-chn3w3j		
diamond/2.0.15-h7xx24l	libgit2/1.6.4-	

a432pgi	pcr2/10.42-xs64jg	vasp-
mpi/6.4.2_cfgoldsm_vtst-cff5qmk		
dicombrowser/20181217s-ikvqhyr	libiconv/1.17-	
jwjcds2	pdftk/2.02-gu7lpeg	vasp-
mpi/6.4.2_cfgoldsm-7krhcss		
dlib/19.22-lxah7rq	libjpeg-turbo/2.1.5-	
sewtk5u	pdsh-chaos/23.12-t6ywlrp	vasp-
mpi/6.4.3_cfgoldsm-5dioee2		
dmtcp/3.0.0-xvfukfp	libjpeg/9e-	
6djp5nd	perl-dbi/1.643-t74vmeb	vasp-
mpi/6.4.3_yqi27-wannier-livyes6		
dorado/0.8.2-s42dhri	libnsl/1.3.0-	
calriiy	perl/5.26.2-o4iq4b4	vasp-
mpi/6.4.3_yqi27-6uzdgwn	(D)	
dos2unix/7.4.2-5a6dlgt	libnsl/2.0.1-ed2i5hn	
(D) perl/5.36.0-bt34quz	(D) vcftools/0.1.14-syssqsi	
dotnet/8.0.100-5lr7bga	libpng/1.2.57s-	
lve65hz	perl/5.37.9-og4osvm	vim/9.1.0867-
wl3haj7		
dropest/0.8.6-ewwx5ik	libpng/1.5.30-	
ru3zswz	perl/5.40.0-o7hxc12	virtualgl/3.1-
yphbrfj		
ds/9.8.5s-zpqg2jy	libpng/1.6.39-ryxiwrd	
(D) picard/2.26.2-qabtyqy	visit-container/3.3.3-qz3dni6	
dsi-studio/chen-2023-sif-lytwlk2	libreoffice/7.2.2.sif-	
drpjygp	pigz/2.7-zgdlry3	visit-mpi/3.3.3s-lz2dp7m
dtitk/2.3.1s-bp7yqjh	libsdl/2.30.7-	
4rxs72s	plink/1.9-beta6.27-nvy4vrX	vmd/1.9.3-oin2dnj
eigen/3.4.0-uyccckhi	libsodium/1.0.20-	
4o75gk3	plink/2.00-b6x44xw	(D) vscode/1.84.2-
4tfimgp		
eigensoft/7.2.1-6ctbhoz	libtiff/4.5.0-	
g6fga7e	popoolation2/1.205s-luyjn2b	vscode/1.97.2-
txhgk3l	(D)	
emacs/28.2-rwds2pd	libtree/3.1.1-	
yxst452	postgresql/16.4-vzmexkn	wcstools/3.9.7-
lo4forb		
expat/2.5.0-zujcztp	libvips/8.13.3-	
ex4pfpq	prodigal/2.6.3-vbq7usx	wxwidgets/3.2.2.1-
mk5eiyq		

fastme/2.1.5.1-kmg5til	libwnck/3.24.1-	
4gvyjhg	proj/9.2.0-ni5rcfb	xcrysden/1.5.60-
nuxe46i		
fastp/0.23.4-xmfbk37	libx11/1.8.4-	
qdzkebe	protobuf/3.22.2-6hlkkut	xerces-c/3.3.0-
djupwmt		
fastq-screen/0.15.3-7ymgrux	libxc/4.3.4-	
uy5ogwb	py-ase/3.21.0-pyuljod	xeyes/1.2.0-
nge56yb		
fastqc/0.11.9-mvd2uhw	libxc/5.2.3-ncc5ir4	
(D) py-matplotlib/3.7.1-4afsjsz	xgboost/1.6.2-fp3ii65	
fastqc/0.12.1-sk2rb3a	(D) libyaml/0.2.5-	
wdpye7g	py-statsmodels/0.13.2-sbdhj4k	yaml-cpp/0.7.0-
6nno2ru		
fasttree/2.1.11-o5kvig7	libzip/1.3.2-	
qwqikw6	py-sympy/1.11.1-gqgr7wu	zlib/1.2.13-
jv5y5e7		
fastx-toolkit/0.0.14-zhaxiyn	liggghts/3.8.0s-	
rqph5mk	pycharm-community/2021.3.3-weqrclly	zoxide/0.9.2-
ydhiqq6		
ferret/7.6.0-i6u5m7q	linaro-forge/23.1.2-	
pk2lobu	pypy/7.3.13-6a5ma5j	zstd/1.5.5-zokfqsc
ffmpeg/6.0-fy677gn	llvm/16.0.2-	
mq6g5lb	python/3.9.16s-x3wdttvt	
ffmpeg/7.0-xny2fb2	(D) lmod/8.7.24-	
w2akdkb	python/3.11.0s-ixrhc3q	(D)
fiji/20231107-1617-espdc7g	macaulay2-container/1.2-	
vupc5gy	qgis/3.28.3-5axmqsj	

Oscar: Sage

Loading and Launching Sage

1. Once authenticated to Oscar, use the following commands at the command line.
2. Start an interactive job by using the `interact` command. This command can take [additional parameters](#) to extend the resources and time allotted to the node as well as the partition that the node operates on.
3. The Sage module provides containers. To load them, use `module load sage-container/10.3` (if running Oscar in PuTTY, pasting text is done by right-clicking).
4. To start the container, use `apptainer shell /oscar/rt/9.2/software/0.20-generic/0.20.1/opt/spack/linux-rhel9-x86_64_v3/gcc-11.3.1/sage-container-10.3-avpqiipfsnbneig726l72jrgdmlrivg4m/sage.sif`.
5. Once inside the container's shell, use `sage` to launch the Sage console.

Sage on Oscar OnDemand

The easiest way to run Sage on Oscar OcDemand is to run sage in an interactive job via the terminal in your OnDemand session.

Use the interact command with parameters for your specific job to start the interactive session, then load your modules and run the sage binary (steps 2-4 above).

```
interact -n 2 -m 32g -t 04:00:00 -f 'haswell|broadwell|skylake'
```

Using Sage with Batch Scripts

Thanks to Trevor Hyde from Summer@ICERM 2019 for these instructions.

One method for running computations with Sage on Oscar is to write a script and use the slurm batch scheduler to have Oscar run your script. This requires two pieces:

1. A shell script to configure and submit your batch job to the cluster.
2. Your Sage code/program you'd like to run.

Example Batch Script

sage-batch.sh

```
#!/bin/bash

#SBATCH -J test_program
#SBATCH --array=0-9
#SBATCH -t 1:00:00
#SBATCH --mem=8G

#SBATCH -e data/<oscar-username>/test_output/test%a.err
#SBATCH -o data/<oscar-username>/test_output/test%a.out

module load sage-container/10.3

aptainer shell /oscar/rt/9.2/software/0.20-generic/0.20.1/opt/spack/linux-rhel9-
x86_64_v3/gcc-11.3.1/sage-container-10.3-avpqiufsbnbeig726l72jrgdmlrivg4m/sage.sif

sage test_program.sage $SLURM_ARRAY_TASK_ID
```

- `#!/bin/bash` tells the system this is a bash (shell) script.
- `#SBATCH -J test_program` sets the name of the job which appears when you check the status of your jobs.
- `#SBATCH --array=0-9` is an easy way of doing parallel computations. In this case it says our job will run on 10 different nodes, each node will be passed a parameter and we have specified that the parameters will take the values 0 through 9. You can specify several ranges or even list individual parameters if you prefer.
- `#SBATCH -t 1:00:00` specifies a time limit in `HH:MM:SS` for each node. Once this time runs out your program will stop running on that node. Be careful setting the time limit too high as doing so may make it take a long time for your job to get scheduled to run. Before starting a big computation try to do some smaller tests to see how long you expect to need.
- `#SBATCH --mem=8G` specifies how much memory each node gets. Standard exploratory accounts get 123GB total to use at any one time. So if you allocate too much per job, fewer jobs will run at once. On the other hand, if you allocate too little and a computation needs more than it has, then it will terminate. If this happens an “out of memory” error will show up in the `.err` file for that node.
- `#SBATCH -e data/<ccv-username>/test_output/test%a.err` and `#SBATCH -o data/<ccv-username>/test_output/test%a.out` specify where the error messages and output for each computation should be sent. You should store these files in your user folder, not on the submit node. We each have a folder inside the `data` directory which you can see from the

submit node. In this example I have created a folder titled `test_output` where I'm putting both of these files. **You need to make these folders before you run the computation otherwise the output will be dumped into the void!** The `%a` will get replaced with the array parameter. So for example, since we set our array parameters to be `0-9` there will be 10 nodes running and each of them gets a number between 0 and 9; this node corresponding to the parameter 7 will create two files `test7.err` and `test7.out`.

- `module load sage-container/10.3` loads the sage container into the node.
- `apptainer shell /oscar/rt/9.2/software/0.20-generic/0.20.1/opt/spack/linux-rhel9-x86_64_v3/gcc-11.3.1/sage-container-10.3-avpqi pfsnbneig726l72jrgdmlrivg4m/sage.sif` initiates the container's Sage console shell.

Everything after this in the script happens as if you typed it yourself onto the command line.

- In our example, we want to run sage code, so the line `sage test_program.sage` `$SLURM_ARRAY_TASK_ID` runs our example sage program `test_program.sage`.
- The file needs to have the `.sage` extension.
- You should write this file in a text editor, not in a Jupyter notebook (although you can first write and test your program in a Jupyter notebook and then copy and paste it into a new file when it's ready).
- This program is written to accept one input and I have passed it `$SLURM_ARRAY_TASK_ID` which is the array parameter passed to each node. You can use this parameter to select which input parameters to run your program on.

Example Sage Program

`test_program.sage`

```
import sys

def fun_math(message):
    print message
    sys.stdout.flush()

job_id = int(sys.argv[1])
fun_math('hi this is a test')
fun_math('my job id is' + str(job_id))
```

- In the Sage program, you first define all of your functions and then you include the code you want to run.
- Import `sys` so you can access the array parameter passed to your function from the node. This is accessed in this case by `sys.argv[1]`. Make sure you explicitly coerce to be an integer if you want to use it as an integer; it's a string by default.

- The output of the `print` command is appended to the `.out` file for this node as a new line.
- Notice the line `sys.stdout.flush()` included in the function. This makes the program immediately send whatever output it has to the output file when called. Otherwise the program won't output **anything** until it has completely finished running. If each node is running 100 potentially long computations and it finishes the first 99 but then times out on the 100th computation, and you don't include any `sys.stdout.flush()` commands, everything will be lost when time runs out.

Submitting the Batch Job

- To run this batch program go back to the submit node and type `sbatch` `<NAME_OF_BATCH_FILE>`. In our example here, our batch file is called `sage-batch.sh`, so we simply type `sbatch sage-batch.sh`. Slurm will return a line that tells you your job has been submitted together with a job id number.
- To check the progress of your jobs type `myq` from anywhere on Oscar. This will show you what jobs you have running, how much time they have left, and which jobs are still waiting to run. Be patient, sometimes it takes a minute for things to get started.
- If you realize your code is never going to finish or that you've made some terrible mistake, you can cancel a batch job by typing `scancel <JOB_ID>`. You can specify a single node or just put the general job id for the whole run and cancel everything.

Oscar: MATLAB

Loading and Launching MATLAB

1. Open the Terminal and use the following commands at the command line.
2. `module avail matlab` to list all the available matlab versions (if running Oscar in PuTTY, pasting text is done by right-clicking).
3. `module load matlab` to load the latest version of matlab (R2023a). Other versions can be specified with the command `module load matlab/R2019a`.
4. `matlab` to launch the MATLAB app.

Installing MATLAB Packages such as YALMIP

MATLAB script packages, such as [YALMIP](#), can be installed directly by the user on their Oscar account.

1. Open the Terminal and connect to Oscar.
2. Navigate to your home folder by typing `cd ~`
3. `mkdir -p MATLAB`
4. `wget -O yalmip.zip https://github.com/yalmip/yalmip/archive/master.zip`
5. `unzip yalmip.zip`
6. In MATLAB, add the YALMIP-master directory to your path.
 1. In the MATLAB file browser, navigate to the MATLAB folder you created in your home folder. `cd ~/MATLAB`
 2. Right click on the YALMIP-master folder.
 3. Select Add to Path > Selected Folders and Subfolders. This adds the YALMIP folders to your path.

7. To save your MATLAB path, use the savepath command in the MATLAB command prompt.

```
savepath ~/MATLAB/pathdef.m
```

YALMIP also requires a solver like [SDPT3](#). The steps below add SDPT3 to MATLAB.

1. Open the Terminal.

2. `cd ~/MATLAB`

3. `wget -O sdpt3.zip https://github.com/sqlp/sdpt3/archive/master.zip`

4. `unzip sdpt3.zip`

5. In MATLAB, add the sdpt3 directory to your path.

1. In the MATLAB file browser, navigate to the MATLAB folder you created in your home folder. `cd ~/MATLAB`

2. Right click on the sdpt3-master folder.

3. Select Add to Path > Selected Folders and Subfolders. This adds the SDPT3 folders to your path.

6. To update/save your MATLAB path, use the savepath command in the MATLAB command prompt. `savepath ~/MATLAB/pathdef.m`

Oscar: Mathematica

Loading and Launching Mathematica

1. Open the Terminal and use the following commands at the command line.
2. Start an interactive job by using the `interact` command. This command can take [additional parameters](#) to extend the resources and time allotted to the node as well as the partition that the node operates on.
3. Command `module avail mathematica` to list all the available Mathematica versions (if running Oscar in PuTTY, pasting text is done by right-clicking).
4. Command `module load mathematica` to load the latest Mathematica version.
5. Command `mathematica` to launch the Mathematica app.

Oscar: R

Loading and Launching R

1. Once authenticated to Oscar, use the following commands at the command line.
2. Start an interactive job by using the `interact` command. This command can take [additional parameters](#) to extend the resources and time allotted to the node as well as the partition that the node operates on.
3. To load R, use `module load r/4.4.2-re5rjx3`, or another version of your preference (if running Oscar in PuTTY, pasting text is done by right-clicking).
4. Once inside the container's shell, use `R` to launch the R console.

Installing R packages

1. R packages need to be installed locally.
2. First, load the R version that you want to use the package with: `module load r/4.2.2`.
3. Start R Session `R`.
4. For packages that require code to be compiled, install them in the log in node. Refer to more information [here](#).
5. To reinstall packages, start a new session by:

```
module load r/4.2.2
R
```

6. Then, update packages with `update.packages(checkBuilt=TRUE, ask=FALSE)`.
7. To uninstall packages, start an R session. Then run `remove.packages("wordcloud")` (word cloud can be replaced with string of another package name).

Oscar: Macaulay 2

Loading and launching Macaulay 2

Once authenticated to Oscar, use the following commands at the command line.

1. Start an interactive job by using the `interact` command. This command can take [additional parameters](#) to extend the resources and time allotted to the node as well as the partition that the node operates on.
2. The Macaulay 2 module provides containers. To load them, use `module load macaulay2-container/1.2-vupc5g` (if running Oscar in PuTTY, pasting text is done by right-clicking).
3. To start the container use `apptainer shell $MACAULAY2_CONTAINER`.
4. Once inside the container's shell, use `M2` to launch the Macaulay console.

Oscar: Magma

Loading and launching Magma

1. Once authenticated to Oscar, use the following commands at the command line.
2. Magma requires a GPU partition. Start an interactive node by commanding `interact -q gpu` (if running Oscar in PuTTY, pasting text is done by right-clicking).
3. To load Magma, use `module load magma-usyd/V2.28-8-p3zylpg`.
4. Use `magma` to launch the Magma console.