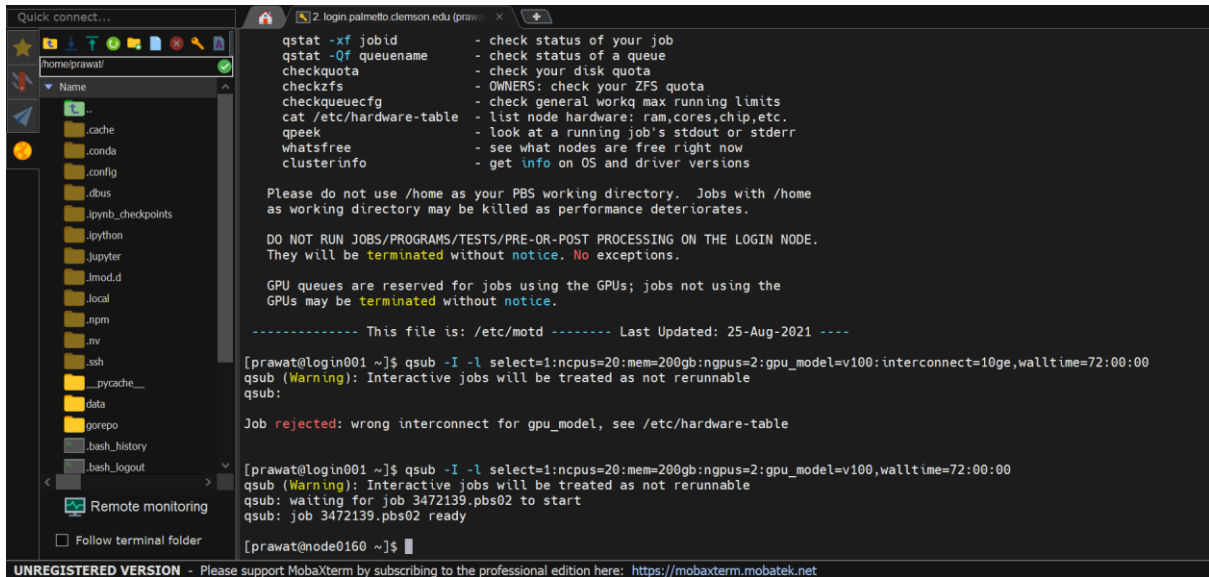


Homework 1

Question 1- Answers:

(1) Show screenshots of successful installation and procedure of the setup. (15 points)



The screenshot shows a MobaXterm terminal window with a file explorer on the left displaying the home directory of 'prawat'. The terminal output includes a list of useful commands for PBS, a warning about not using /home as a working directory, and the execution of the 'qsub' command to submit a job. The job is rejected due to an incorrect 'gpu_model' specification. The user then corrects the command and successfully submits the job.

```
qstat -xf jobid          - check status of your job
qstat -Qf queueName      - check status of a queue
checkquota               - check your disk quota
checkzfs                 - OWNERS: check your ZFS quota
checkqueuecfg            - check general workq max running limits
cat /etc/hardware-table  - list node hardware: ram,cores,chip,etc.
qpeek                    - look at a running job's stdout or stderr
whatsfree                 - see what nodes are free right now
clusterinfo               - get info on OS and driver versions

Please do not use /home as your PBS working directory. Jobs with /home
as working directory may be killed as performance deteriorates.

DO NOT RUN JOBS/PROGRAMS/TESTS/PRE-OR-POST PROCESSING ON THE LOGIN NODE.
They will be terminated without notice. No exceptions.

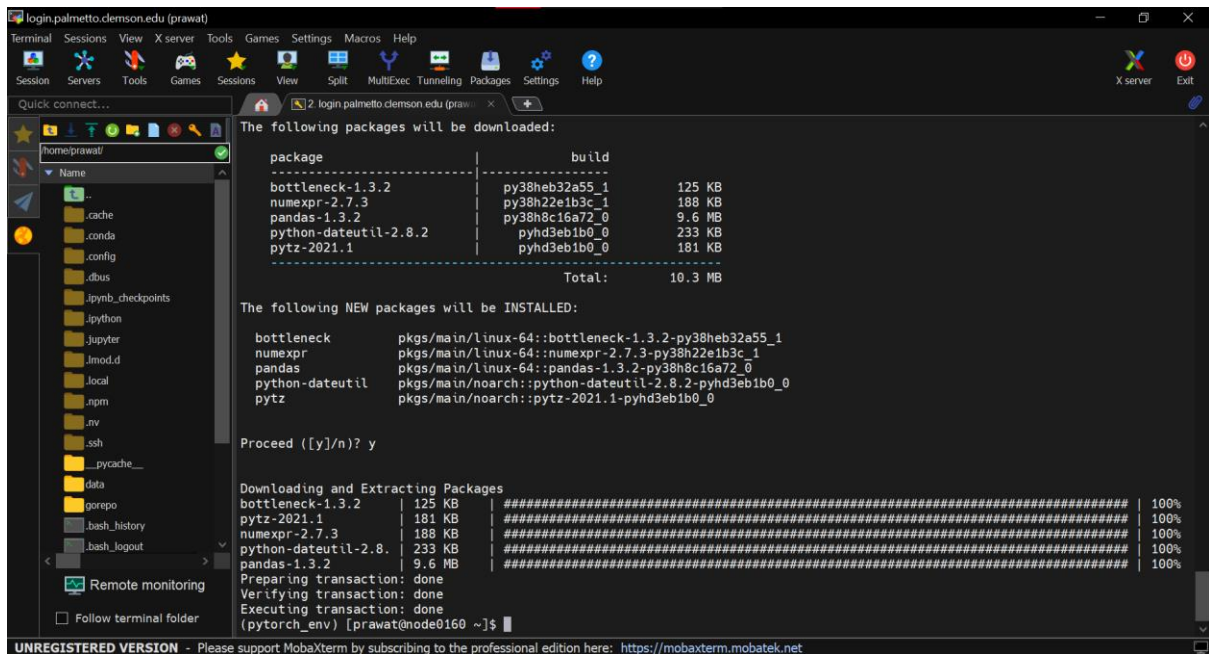
GPU queues are reserved for jobs using the GPUs; jobs not using the
GPUs may be terminated without notice.

----- This file is: /etc/motd ----- Last Updated: 25-Aug-2021 -----

[prawat@login001 ~]$ qsub -I -l select=1:ncpus=20:mem=200gb:ngpus=2:gpu_model=v100:interconnect=10ge,walltime=72:00:00
qsub (Warning): Interactive jobs will be treated as not rerunnable
qsub:
Job rejected: wrong interconnect for gpu_model, see /etc/hardware-table

[prawat@login001 ~]$ qsub -I -l select=1:ncpus=20:mem=200gb:ngpus=2:gpu_model=v100,walltime=72:00:00
qsub (Warning): Interactive jobs will be treated as not rerunnable
qsub: waiting for job 3472139.pbs02 to start
qsub: job 3472139.pbs02 ready

[prawat@node0160 ~]$
```



The screenshot shows the same MobaXterm terminal window, now displaying the installation of several Python packages. A table lists the packages to be downloaded, followed by a list of the new packages to be installed. The user proceeds with the installation, and a progress bar shows the download and extraction of the packages.

```
The following packages will be downloaded:

package                                build                                125 KB
bottleneck-1.3.2                       py38heb32a55_1                      188 KB
numexpr-2.7.3                          py38h22e1b3c_1                      9.6 MB
pandas-1.3.2                           py38h8c16a72_0                      233 KB
python-dateutil-2.8.2                  pyhd3eb1b0_0                        181 KB
pytz-2021.1                             pyhd3eb1b0_0
Total:                                  10.3 MB

The following NEW packages will be INSTALLED:

bottleneck      pkgs/main/linux-64::bottleneck-1.3.2-py38heb32a55_1
numexpr         pkgs/main/linux-64::numexpr-2.7.3-py38h22e1b3c_1
pandas          pkgs/main/linux-64::pandas-1.3.2-py38h8c16a72_0
python-dateutil pkgs/main/noarch::python-dateutil-2.8.2-pyhd3eb1b0_0
pytz            pkgs/main/noarch::pytz-2021.1-pyhd3eb1b0_0

Proceed ([y]/n)? y

Downloading and Extracting Packages
bottleneck-1.3.2 | 125 KB | ##### 100%
pytz-2021.1      | 181 KB | ##### 100%
numexpr-2.7.3    | 188 KB | ##### 100%
python-dateutil-2.8.2 | 233 KB | ##### 100%
pandas-1.3.2     | 9.6 MB | ##### 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done
(pytorch_env) [prawat@node0160 ~]$
```

```
login.palmetto.clemson.edu (prawat)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
home:prawat/
Name
.cache
.conda
.config
.dbus
.ipynb_checkpoints
.ipynb
.jupyter
.local
.npm
.nv
.ssh
.pycache
.data
.gorepo
.bash_history
.bash_logout
Remote monitoring
Follow terminal folder

bottleneck          pkgs/main/linux-64::bottleneck-1.3.2-py38heb32a55_1
numexpr              pkgs/main/linux-64::numexpr-2.7.3-py38h22e1b3c_1
pandas               pkgs/main/linux-64::pandas-1.3.2-py38h8c16a72_0
python-dateutil      pkgs/main/noarch::python-dateutil-2.8.2-pyhd3eb1b0_0
pytz                 pkgs/main/noarch::pytz-2021.1-pyhd3eb1b0_0

Proceed ([y]/n)? y

Downloading and Extracting Packages
bottleneck-1.3.2          125 KB | ##### | 100%
pytz-2021.1               181 KB | ##### | 100%
numexpr-2.7.3            188 KB | ##### | 100%
python-dateutil-2.8.2    233 KB | ##### | 100%
pandas-1.3.2             9.6 MB | ##### | 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done
(pytorch_env) [prawat@node0160 ~]$ python
Python 3.8.3 (default, Jul 2 2020, 16:21:59)
[GCC 7.3.0] :: Anaconda, Inc. on linux
Type "help", "copyright", "credits" or "license()" for more
>>> import torch
print(torch.cuda.is_available())
File "<stdin>", line 1
      print(torch.cuda.is_available())
SyntaxError: multiple statements found while compiling a single statement
>>> import torch
>>> print(torch.cuda.is_available())
True
>>>
```

```
login.palmetto.clemson.edu (prawat)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...
home:prawat/
Name
.cache
.conda
.config
.dbus
.ipynb_checkpoints
.ipynb
.jupyter
.local
.npm
.nv
.ssh
.pycache
.data
.gorepo
.bash_history
.bash_logout
Remote monitoring
Follow terminal folder

pysocks              conda-forge/linux-64::pysocks-1.7.1-py38h578d9bd_3
python_abi            conda-forge/linux-64::python_abi-3.8-2_cp38
pyzmq                 conda-forge/linux-64::pyzmq-19.0.2-py38ha71036d_2
requests              conda-forge/noarch::requests-2.26.0-pyhd8ed1ab_0
requests-unixsock     conda-forge/noarch::requests-unixsocket-0.2.0-py_0
send2trash            conda-forge/noarch::send2trash-1.8.0-pyhd8ed1ab_0
sniffio               conda-forge/linux-64::sniffio-1.2.0-py38h578d9bd_1
terminado             conda-forge/linux-64::terminado-0.11.1-py38h578d9bd_0
testpath              conda-forge/noarch::testpath-0.5.0-pyhd8ed1ab_0
tornado               conda-forge/linux-64::tornado-6.1-py38h497a2fe_1
traitlets             conda-forge/noarch::traitlets-5.1.0-pyhd8ed1ab_0
urllib3               conda-forge/noarch::urllib3-1.26.6-pyhd8ed1ab_0
wcwidth               conda-forge/noarch::wcwidth-0.2.5-py9f0ad1d_2
webencodings          conda-forge/noarch::webencodings-0.5.1-py_1
websocket-client       conda-forge/linux-64::websocket-client-0.57.0-py38h578d9bd_4
zeromq                conda-forge/linux-64::zeromq-4.3.4-h9c3ff4c_0
zipp                  conda-forge/noarch::zipp-3.5.0-pyhd8ed1ab_0

The following packages will be SUPERSEDED by a higher-priority channel:
ca-certificates       pkgs/main::ca-certificates-2021.7.5-h~ --> conda-forge::ca-certificates-2021.5.30-ha878542_0
certifi                pkgs/main::certifi-2021.5.30-py38h06a~ --> conda-forge::certifi-2021.5.30-py38h578d9bd_0

Proceed ([y]/n)? y

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
(pytorch_env) [prawat@node0160 ~]$ python -m ipykernel install --user --name pytorch_env --display-name Pytorch
Installed kernelspec pytorch_env in /home/prawat/.local/share/jupyter/kernels/pytorch_env
(pytorch_env) [prawat@node0160 ~]$ cd
(pytorch_env) [prawat@node0160 ~]$ nano .jupyter
(pytorch_env) [prawat@node0160 ~]$
```

Server Options

CPU Cores per Chunk (ncpus)

1

Amount of Memory per Chunk (mem)

14gb

Number of GPUs per chunk (ngpus)

2

GPU Model

V100

Interconnect

Any

Walltime (limit) of Jupyter Notebook Server

8 hours

Queue

work1

☐ Show Advanced Options?

Start

(2) Run the existing sample code “base.ipynb” (5 points)

During the training, what's your GPU usage percentage? (You can open another terminal and use "nvidia-smi -l" to monitor the usage info of GPU and GPU memory.)

[illegible]

(3) Modify the code for better performance (change the batch size) (10 points)

During the training, what's your GPU usage percentage?

- I took the batch size = 8, and during training my GPU usage percentage increased to about 29%.

Processes:

GPU	GI	CI	PID	Type	Process name	GPU Memory Usage
0	N/A	N/A	4616	G	/usr/libexec/Xorg	22MiB
0	N/A	N/A	3764233	C	...e/prawat/myenv/bin/python	1987MiB
1	N/A	N/A	4616	G	/usr/libexec/Xorg	22MiB

Sun Sep 5 12:20:58 2021

GPU	Name	Persistence-M	Bus-Id	Disp.A	Volatile	Uncorr.	ECC
Fan	Temp	Perf	Pwr:Usage/Cap	Memory-Usage	GPU-Util	Compute M.	MIG M.
0	Tesla V100-PCIE...	Off	00000000:38:00:0	Off	29%	Default	0
N/A	37C	P0	65W / 250W	2013MiB / 16160MiB			N/A
1	Tesla V100-PCIE...	Off	00000000:08:00:0	Off	0%	Default	0
N/A	27C	P0	24W / 250W	26MiB / 16160MiB			N/A

Processes:

GPU	GI	CI	PID	Type	Process name	GPU Memory Usage
0	N/A	N/A	4616	G	/usr/libexec/Xorg	22MiB
0	N/A	N/A	3764233	C	...e/prawat/myenv/bin/python	1987MiB
1	N/A	N/A	4616	G	/usr/libexec/Xorg	22MiB

(4) Modify the code for better performance (use two GPUs) (10 points)

During the training, what's your GPU info percentage? (TIPS: [reference API](#))

Processes:

GPU	GI	CI	PID	Type	Process name	GPU Memory Usage
0	N/A	N/A	4663	G	/usr/libexec/Xorg	22MiB
0	N/A	N/A	523012	C	...vs/pytorch_env/bin/python	1583MiB
1	N/A	N/A	4663	G	/usr/libexec/Xorg	22MiB
1	N/A	N/A	523012	C	...vs/pytorch_env/bin/python	1499MiB

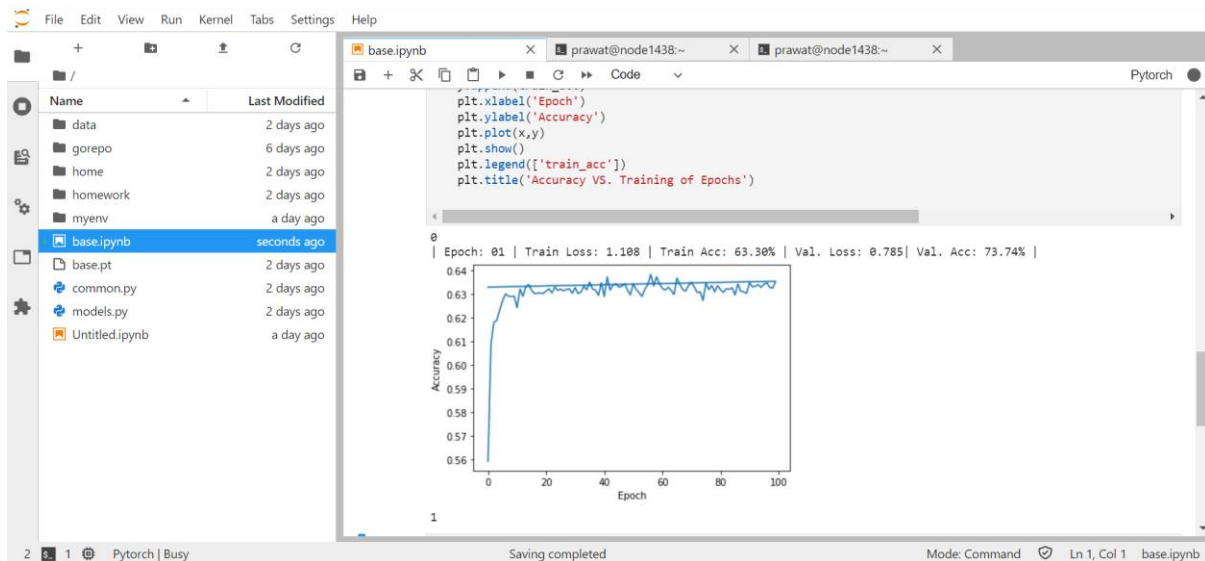
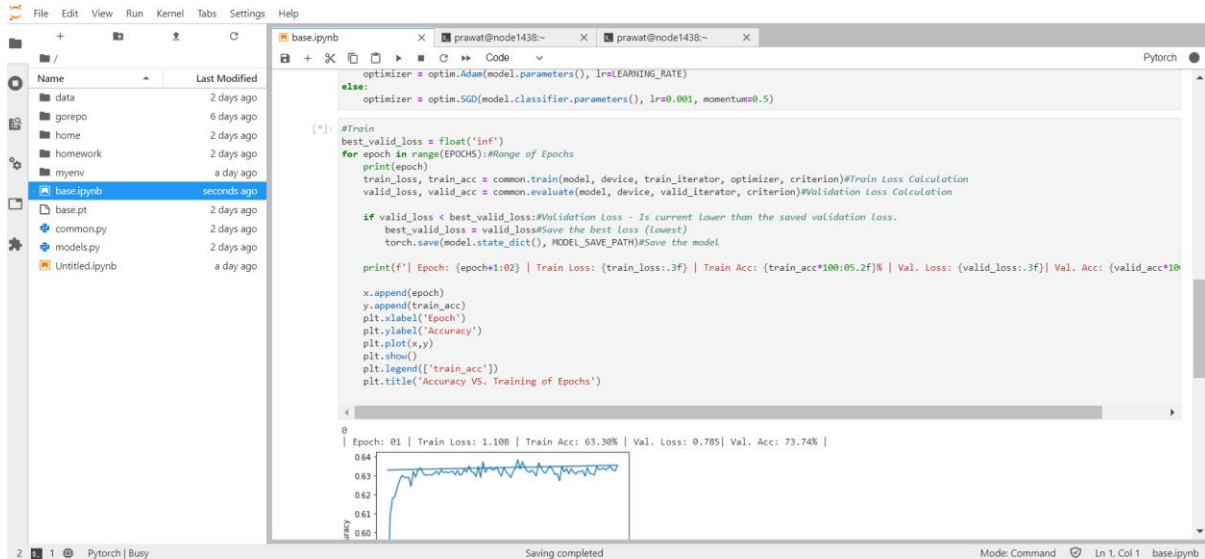
Sun Sep 5 19:17:25 2021

GPU	Name	Persistence-M	Bus-Id	Disp.A	Volatile	Uncorr.	ECC
Fan	Temp	Perf	Pwr:Usage/Cap	Memory-Usage	GPU-Util	Compute M.	MIG M.
0	Tesla V100-PCIE...	Off	00000000:38:00:0	Off	36%	Default	0
N/A	33C	P0	50W / 250W	1609MiB / 16160MiB			N/A
1	Tesla V100-PCIE...	Off	00000000:08:00:0	Off	35%	Default	0
N/A	34C	P0	53W / 250W	1521MiB / 16160MiB			N/A

Processes:

GPU	GI	CI	PID	Type	Process name	GPU Memory Usage
0	N/A	N/A	4663	G	/usr/libexec/Xorg	22MiB
0	N/A	N/A	523012	C	...vs/pytorch_env/bin/python	1583MiB
1	N/A	N/A	4663	G	/usr/libexec/Xorg	22MiB
1	N/A	N/A	523012	C	...vs/pytorch_env/bin/python	1499MiB

(5) Plot the accuracy against the number of training Epochs on a Graph. (10 points)
(TIPS: you need to import matplotlib, modify the code of “for epoch in range (EPOCHS):” by saving the “epoch” and “train_acc”, and plot its relationship in the end)



(7) Perform a model inference for a certain image, which you can choose from anywhere. The image shall include the object which belongs to the category of the training dataset. (10 points) (TIPS: if you are using CIFAR10 datasets, its categories are shown in this reference)

