Azure Guide for CS224n

This guide will help you setup and use Azure Virtual Machines for your final project. Before we start, it cannot be stressed enough: **do not leave your machine running when you are not using it**. The expected time to complete the setup guide is **15 min** to **1 hour**, depending on which configuration you opt to take.

Given GPU shortages, your subscriptions do not allow you to use GPU enabled VMs by default. **You must request a quota increase to make use of these machines, and it can take several days to get approval, so please follow the steps required to request a quota increase as soon as possible.**

Contents

Your Azure subscription for this class

Microsoft has generously agreed to sponsor CS224n, and has provided us with Azure credit to distribute to CS224n students. We expect that there will be enough credit for teams to run as many experiments as they need for their projects. **However, it's very important for**

students to manage their credit carefully, so that they can get the most out of it (see next section).

You need Azure credits for assignment 4, assignment 5, and final project. You will receive an email containing an invitation to claim your Azure credits. For the specifics of how much credits you will be provided for each of the assignments, refer to the Azure posts we will make on Ed.

For the final project, a credit of upto $150 will be assigned per team (according to the teams you gave us in your project proposal, depending on total teams formed), with the same amount allocated regardless of team size. The $150 corresponds to about **45 hours** on a NC6 machine.

The $150 is an initial allocation. If you use it up running *genuine* experiments, that's **perfectly OK and completely expected** – we expect that most teams will need more credit, and we have plenty more to give you. However, **please don't use up your credit by leaving your machine running when you're not using it**! Nor should you use up many hours of credit using your VM to write your code (see next section).

When you run out of credit (or before you run out), you can ask us for more on Ed using the "azure" tag.

Best practices for managing your Azure credit

Azure virtual machines are charged at a flat rate, for each minute that they are turned on. This is irrespective of:

- whether you are ssh'd to the machine at that time
- whether you are running any processes on the machine at that time
- the computational intensity of the the processes you're running
- whether you're using GPUs

Therefore, the most important thing you need to do to, to manage your Azure credit, is to **carefully turn your VM on and off just when you need it**. If you are using a NC6 VM, it is charged at $3.366/hour while it is turned on.

We advise you to **develop your code on your local machine** (for example your laptop with the CPU version of PyTorch installed) for debugging (i.e., work on your new code until you are able to complete several training iterations without errors), then run your code on your Azure VM when it's time to train on a GPU.

Note: we have provided you with a CS224N: Practical Tips for Using Virtual Machines 2023 document which gives tips on how to sync your code between your laptop and your VM, how to use tmux to manage your sessions in your VM, and how to monitor your memory/CPU/GPU usage.

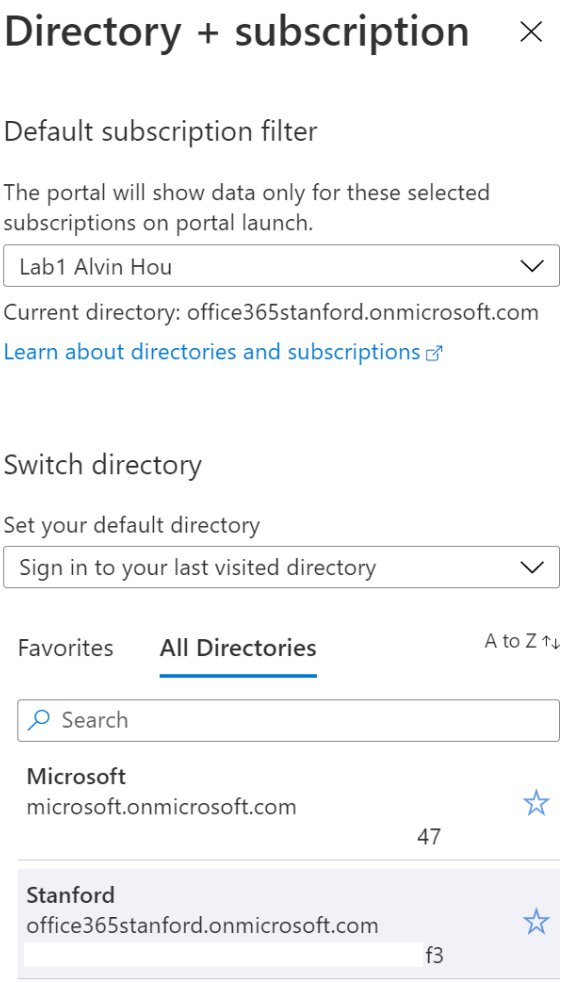
Azure also has an auto-shutdown feature that allows you to specify a time when you want your VM to turn off - this allows you to turn off the machine at a time when you are unable to do it manually. For example, if you start an experiment at 9 p.m., and you want to stop it after 5 hours, you can set auto-shutdown to turn your VM off at 2 a.m. This will prevent you spending credit that you would have otherwise spent until you woke up many hours later to turn off the VM.

See FAQs of this document to learn how to check your balance.

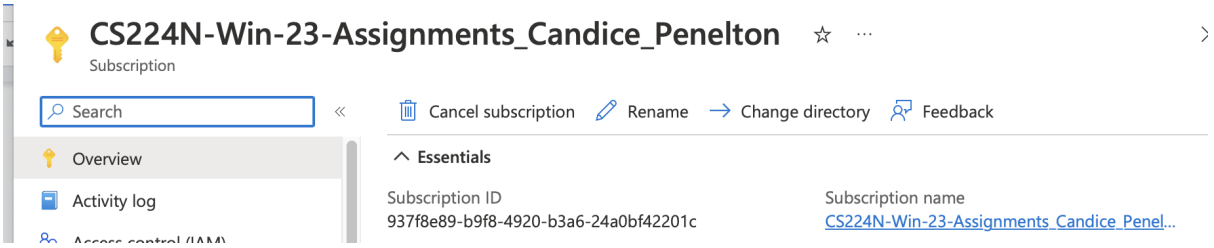
Configuring your Azure VM

Creating an Azure account (5 min)

Login to your account at portal.azure.com using your stanford.edu email address and make sure your **Active Directory** (shown under your email address in the top right corner) is `Stanford - office365stanford.onmicrosoft.com`. If you have multiple subscriptions (e.g. you're sharing the same email account for CS 224N with another course using Azure like CS 234 or CS 273B), click on the **Account Menu** in the top-right corner, select **Switch directory**, and choose `Stanford - office365stanford.onmicrosoft.com`.

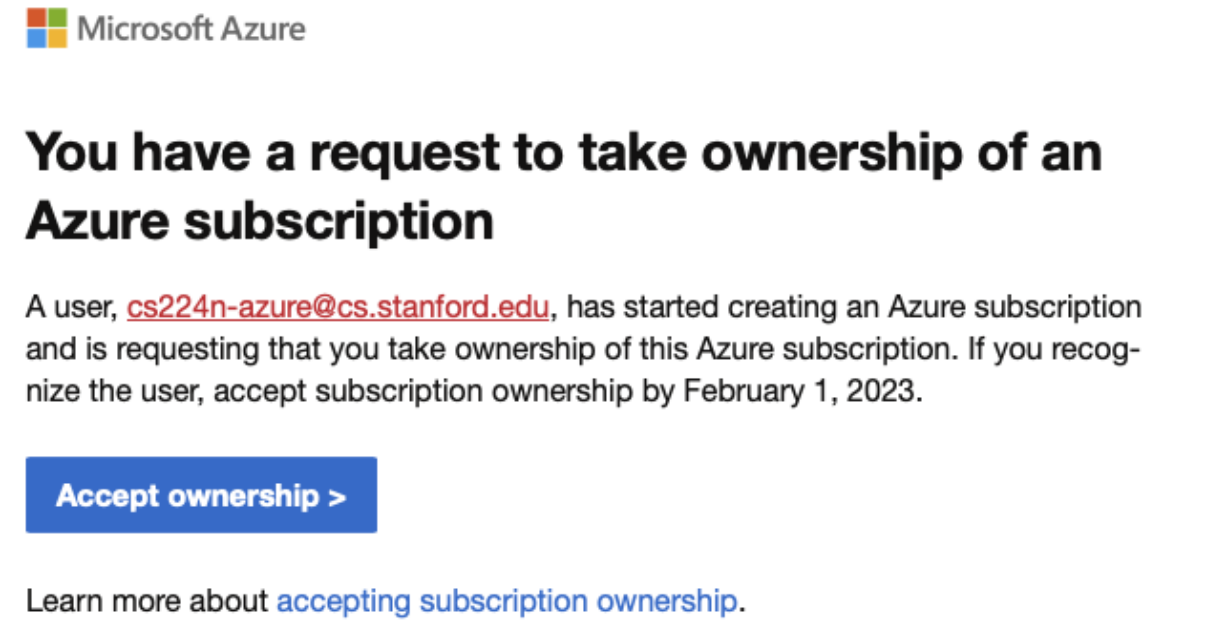


Note that if you accepted your subscription under the cs224nazurecsstanford.onmicrosoft.com directory, then you will need go to subscriptions and change the directory of your subscription to the **`Stanford - office365stanford.onmicrosoft.com`** one.



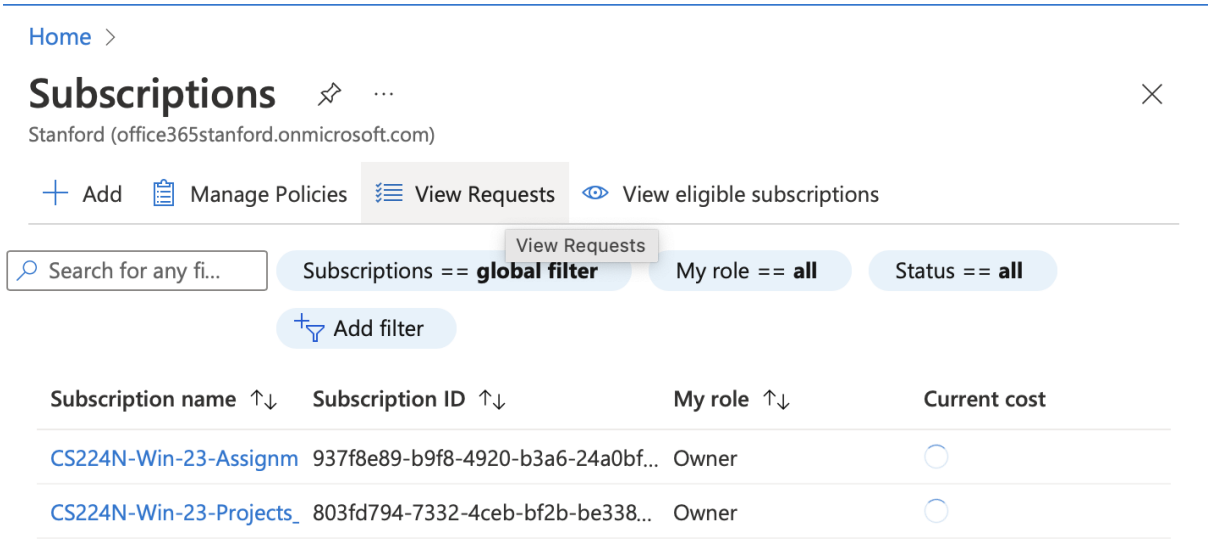
Activating your subscription (5 min)

You will receive an email requesting you to accept your azure credits.

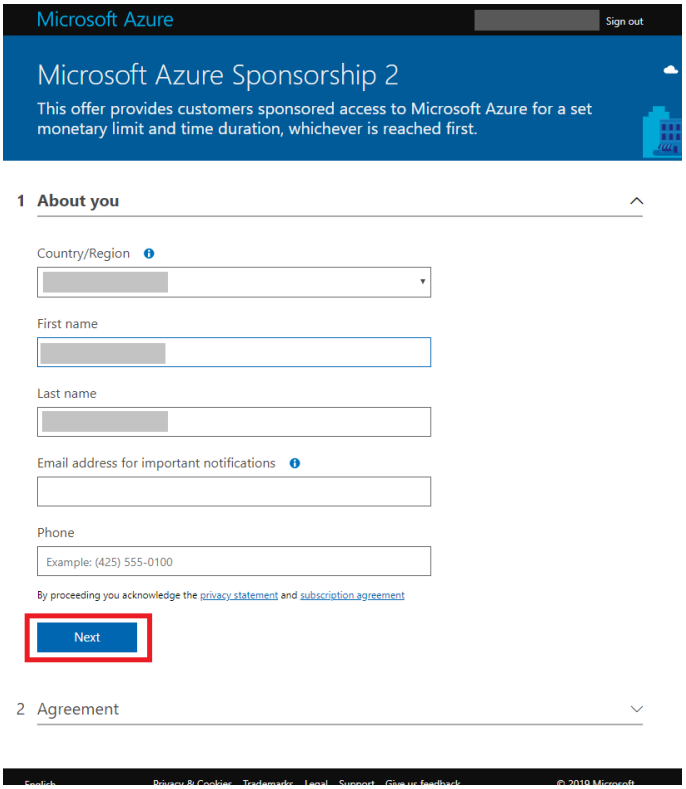


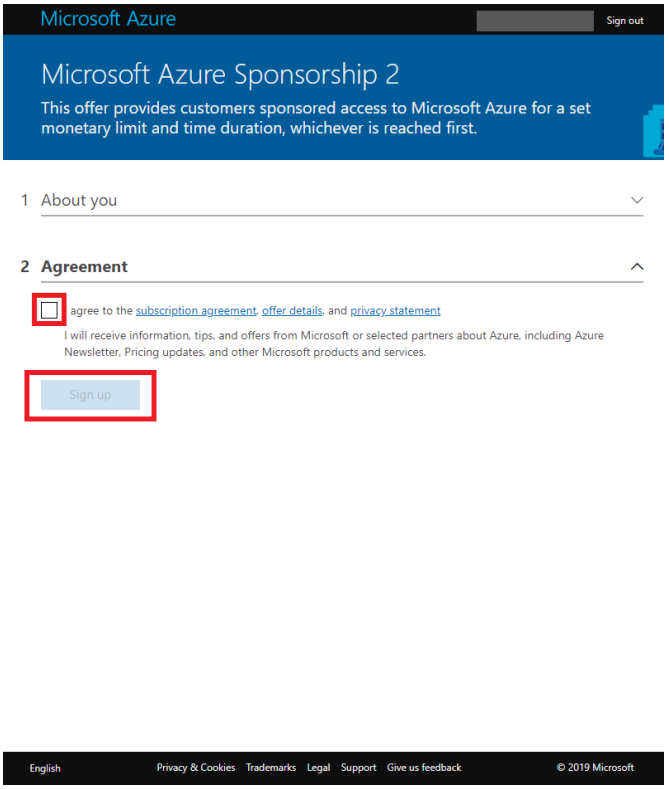
You will first receive an email for your **CS224-Win-23-Assignment credits**, then once we have configured groups, a group leader will receive an email for **C224N-Win-23-Project credits.**

Go to https://portal.azure.com/#view/Microsoft_Azure_Billing/SubscriptionsBlade. You should see **CS224N-Win 2023-Assignments** and later **CS224N-Win-2023-Project** in your list of subscriptions. If you don't see the subscription(s) for CS224N *after accepting the subscription*, see Ed for detailed instructions.



If this is your first time activating a subscription under Azure, you may be brought to the agreement page. **Fill in your information** and click **Next** and **Sign up**. It may take a few minutes for the next page to load after you click **Sign up**.





Creating a VM (15-45 min)

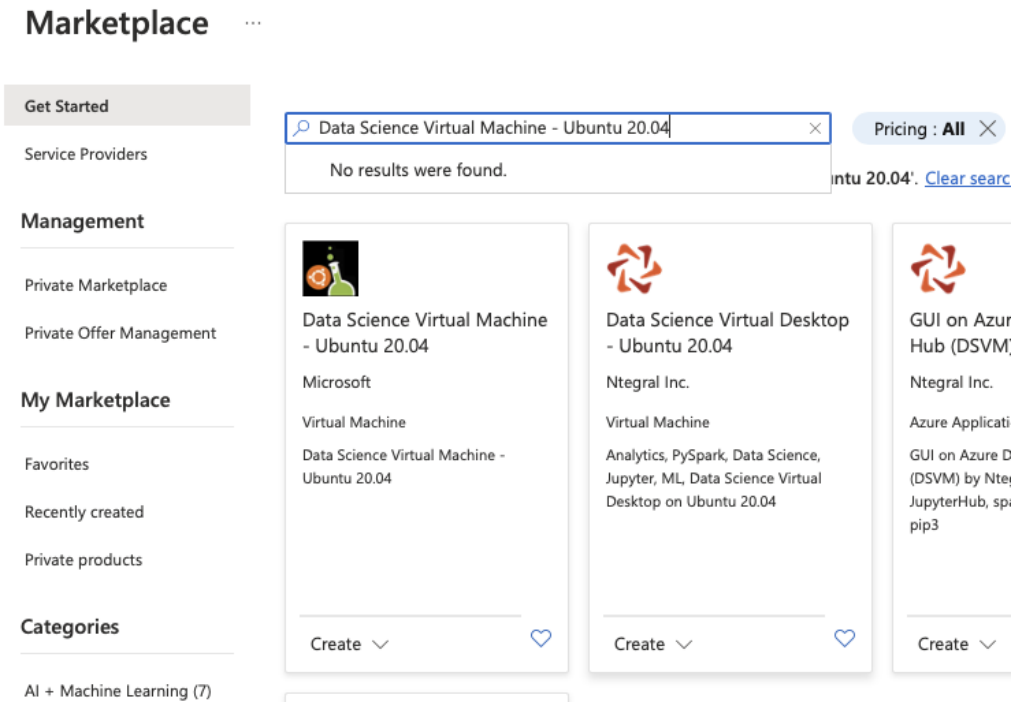
Your account will not initially allow you to provision GPU enabled VMs. You have to submit a quota service increase request first. In order to request a quota increase to use a GPU enabled VM, you must first use the compute resources that will enable you to request changes to resource limits.

Using a predefined image (15 min)

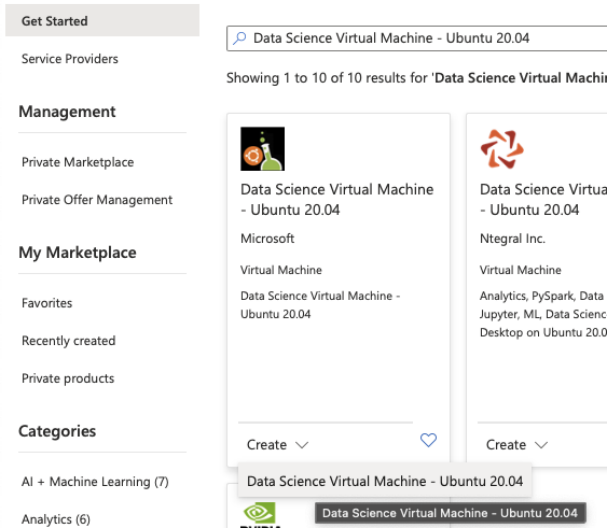
If you use a predefined image, we recommend using the `Data Science Virtual Machine- Ubuntu 20.04` image, which comes installed with Python 3.7, -gpu, tensorflow-gpu, CUDA, and cuDNN.

1. Click the `+ Create a Resource` in the left sidebar menu and type in `Data Science Virtual Machine- Ubuntu 20.04`. It's essential that you select the Ubuntu and **not**

CentOS distribution.



2. Click `Create`.



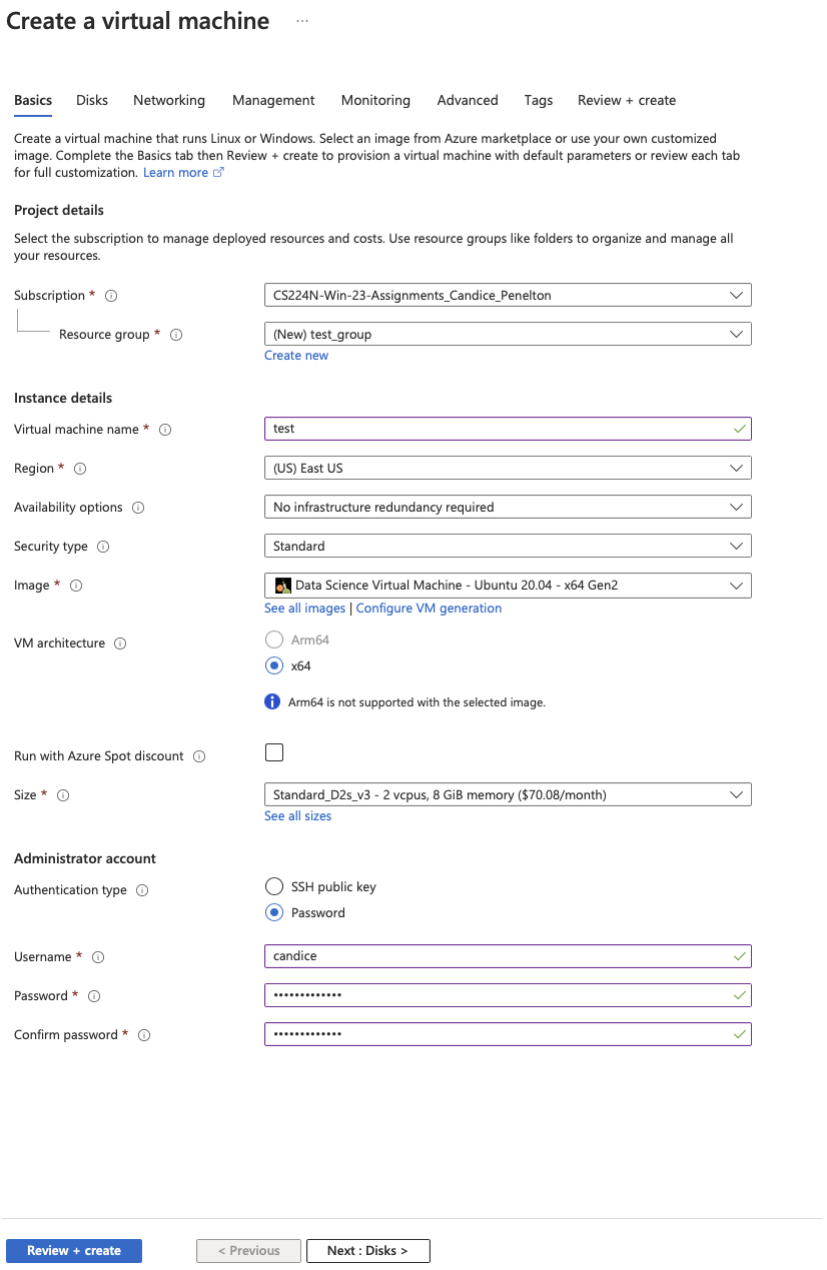
3. Fill in the following fields:

    - **Subscription.**
        i. If you are working on assignments and you see the subscription starting with [`CS224N-Win-23-Assignments_<Your_Name>`], choose this one.
        ii. If you are working on projects, you should see an option starting with [`CS224N-Win-23-Projects_<Your_Name>`]. Choose this one.

iii. The VM that you create will use Azure credits from the subscription chosen, and sometimes may not be transferable to a different subscription. If you don't see the subscription that you are looking for, make sure you follow the section above on *Activating your subscription* carefully. If that still does not resolve your issue, post on Ed for assistance.

- **Resource group.** If you create multiple VMs, those within the same resource group will share resources. Unless you create multiple VMs, this configuration does not matter, so click `Create New` and type `cs224n-gpu`.
  i. **IMPORTANT**. If you are switching to a new subscription (for example from`[CS224N-Win-23-Assignments_<Your_Name>]` to `[CS224N-Win-23-Projects_<Your_Name>]`, you need to create a new resource group.
- **Virtual Machine Name.** This will be the name of your VM. You can name it whatever you want.
- **Region**.
  i. First time: choose one of the recommended regions
  ii. For GPU VM: select one of the US regions where you have been approved to use the one of the NC vCPU families mentioned below
- **Image. IMPORTANT** Choose `Data Science Virtual Machine- Ubuntu 20.04`
- **Size**.
  i. First time: Use the default size option the first time you use your subscription. Once you have used the compute service by creating a VM, you will be able to go to the quota resource management and request GPU enabled VM. You will not be able to request a quota increase without first doing this step.
  ii. After GPU Quota Approval: select **NC6, NC6_Promo, or NC6s_v3** based on what quota request was approved.
- **User name.** This will be the username used on the VM. You can name yourself whatever you want. I named myself `steph`. Since it's most convenient for all of the people in your group to share one user account, it might make more sense to use the name `group` or `team` or `<team-name>` like `purple-elephants`. (I bet your favorite language model didn't expect to see purple elephants in an Azure walkthrough…)
- **Authentication type.** If you are not familiar with SSH keys, authenticate using password; otherwise, choose whichever you prefer. I chose a secret password.

4. Double check the fields with red asterisk below are filled in according to the spec above. Click `Review + create`.



5. Wait for the configuration to validate. Click `Create`. Sometimes, the validation errors. If you don't see `Validation passed`, click on `Basics`, confirm the fields you filled in from the previous step are still there and click Click Review + create to try again.

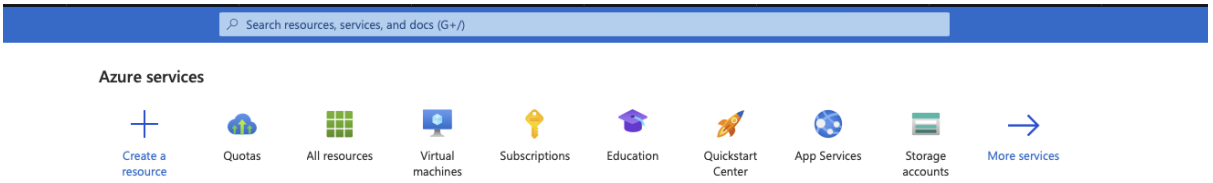
6. You've created a VM! Continue to Using Azure.
    - For the no GPU VM, stop it immediately, **delete it (it will consume a small amount of credits daily otherwise)**, and proceed to requesting a quota increase.Feel free to delete it, as it may consume credits.

NOTE: If you do not plan on using your VM right now, stop the instance **right now.** The VM is automatically started up when it is created. Follow the instructions below to stop your VM.

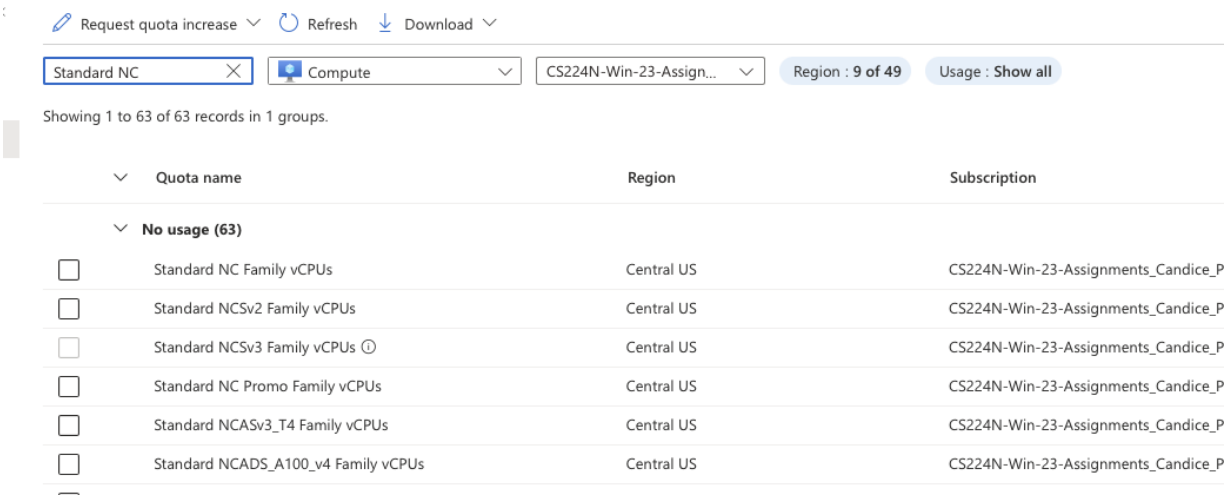
Requesting a Quota Increase

Note that quota options for compute will not appear until after you create a compute resource for the specified subscription (see creating a VM).

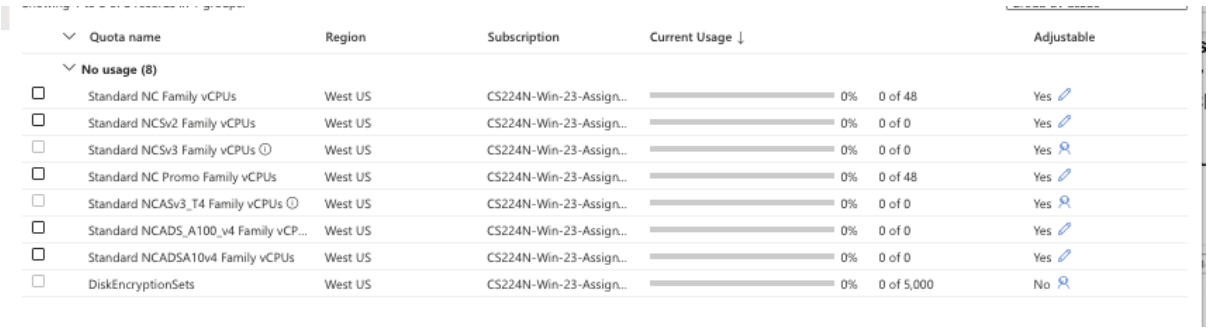
1. Search for and select quotas



2. Select Compute (not classic)
   - 2.1. Filter Regions for all US regions that are not EUAP or STG
   - 2.2. Next in the search bar type Standard NC
     - 2.2.1. Choose one of the following quota names (these vCPUs had GPUs that are CUDA enabled and can use accelerated pytorch, while some GPU options do not. NCSv2 not supported either):
       - Standard NC Family vCPUs
       - Standard NC Promo Family vCPUs
       - Standard NCSv3 Family vCPUs
         - **We can confirm that some students were approved for NCSv3 in the West US and East US region**



Please disregard the box on the right being greyed out. So long as the resources says adjustable on the left, you can request a quota increase by clicking the pencil or human icon.



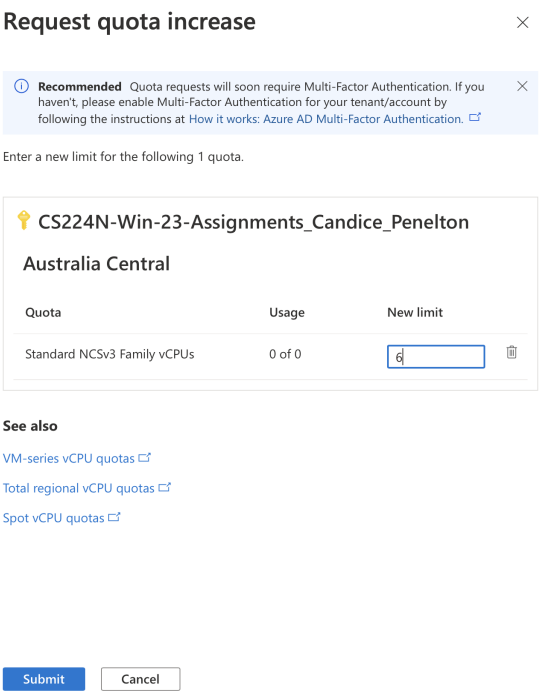
Quota name	Region	Subscription	Current Usage ↓		Adjustable
No usage (8)					
Standard NC Family vCPUs	West US	CS224N-Win-23-Assign...	0%	0 of 48	Yes
Standard NCSv2 Family vCPUs	West US	CS224N-Win-23-Assign...	0%	0 of 0	Yes
Standard NCSv3 Family vCPUs ⓘ	West US	CS224N-Win-23-Assign...	0%	0 of 0	Yes
Standard NC Promo Family vCPUs	West US	CS224N-Win-23-Assign...	0%	0 of 48	Yes
Standard NCASv3_T4 Family vCPUs ⓘ	West US	CS224N-Win-23-Assign...	0%	0 of 0	Yes
Standard NCADS_A100_v4 Family vCP...	West US	CS224N-Win-23-Assign...	0%	0 of 0	Yes
Standard NCADSA10v4 Family vCPUs	West US	CS224N-Win-23-Assign...	0%	0 of 0	Yes
DiskEncryptionSets	West US	CS224N-Win-23-Assign...	0%	0 of 5,000	No

2.3. Select a region that your chosen vCPU is available in refer to chart below and website:

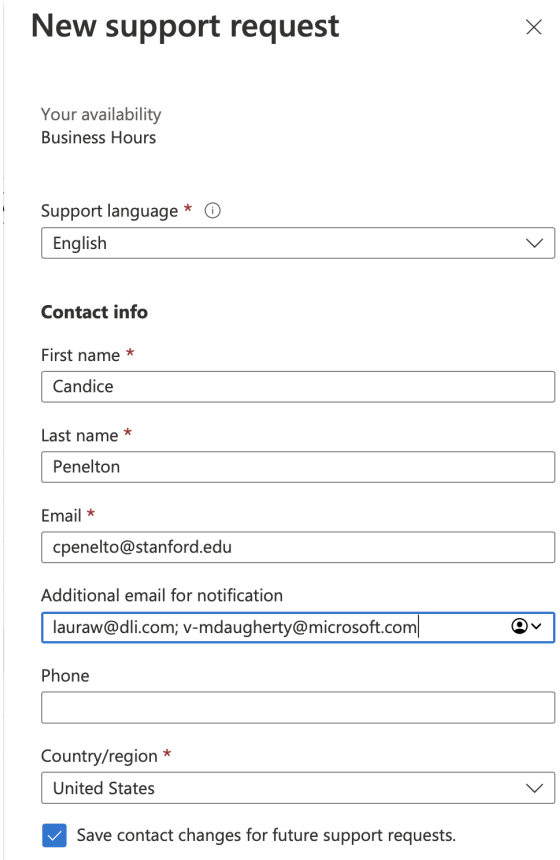
Products	Central US	East US	East US 2	North Central US	South Central US	West Central US	West US	West US 2	West US 3
NC-series		✓	✓	✓	✓			✓	
NCasT4v3-series		✓	✓		✓		✓	✓	✓
NCads A10 v4 series									☐
NC A100 v4 Series		✓	✓		✓		✓	✓	✓
NCsv2-series		✓			✓			✓	
NCsv3-series	✓	✓	✓		✓		✓	✓	✓

2.4. Select a quota that is adjustable (as in it says Yes for the adjustable column) and request approval . Please note that Azure allows you to request quota for VCPUs that are not available in that region, so double check the availability website before requesting. Otherwise, your request will be closed.

2.4.1. Request 6 vCPUs



2.4.2. When you click submit you will get to edit your contact details. **Include the following emails for notification:**
lauraw@dli.com,v-mdaugherty@microsoft.com
DO NOT SEND EMAILS TO THESE CONTACTS



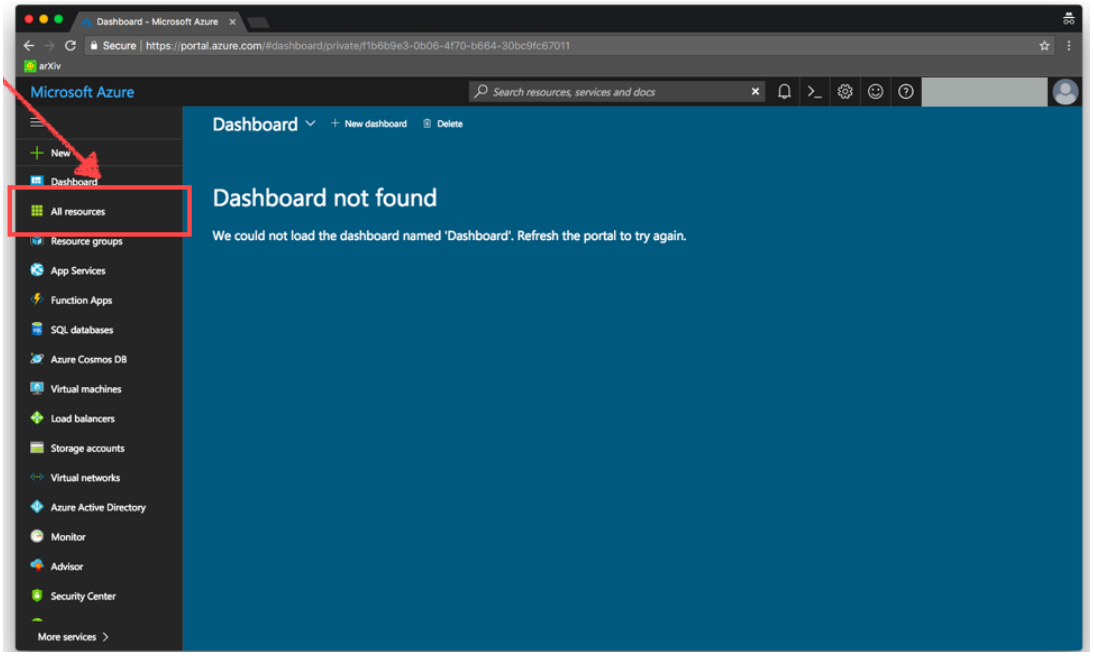
3. Wait for a notification that your quota has been approved.

4. Once your quota has been approved create a new VM and select the VM size and region that matched the vCPU family you have approval for.

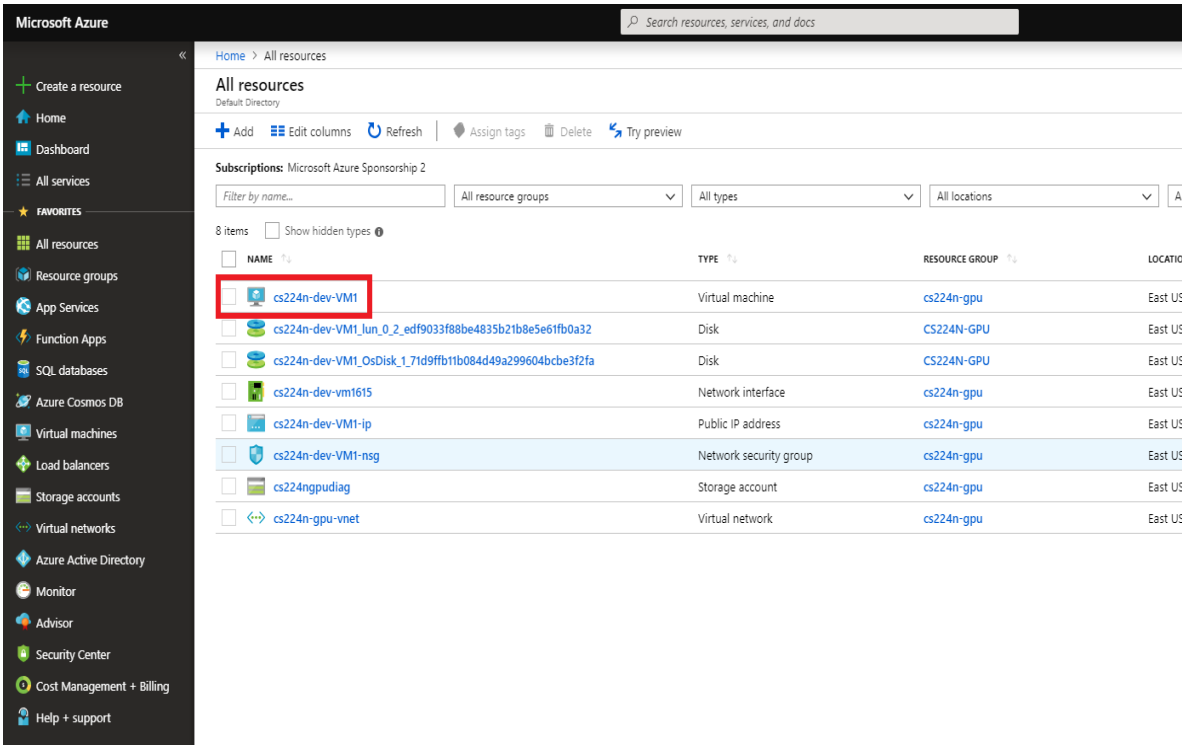
Using Azure

Managing a VM

1. Click the `All resources` in the left sidebar menu. If it is not on the left sidebar, click on All services in the sidebar, and All resources from there.

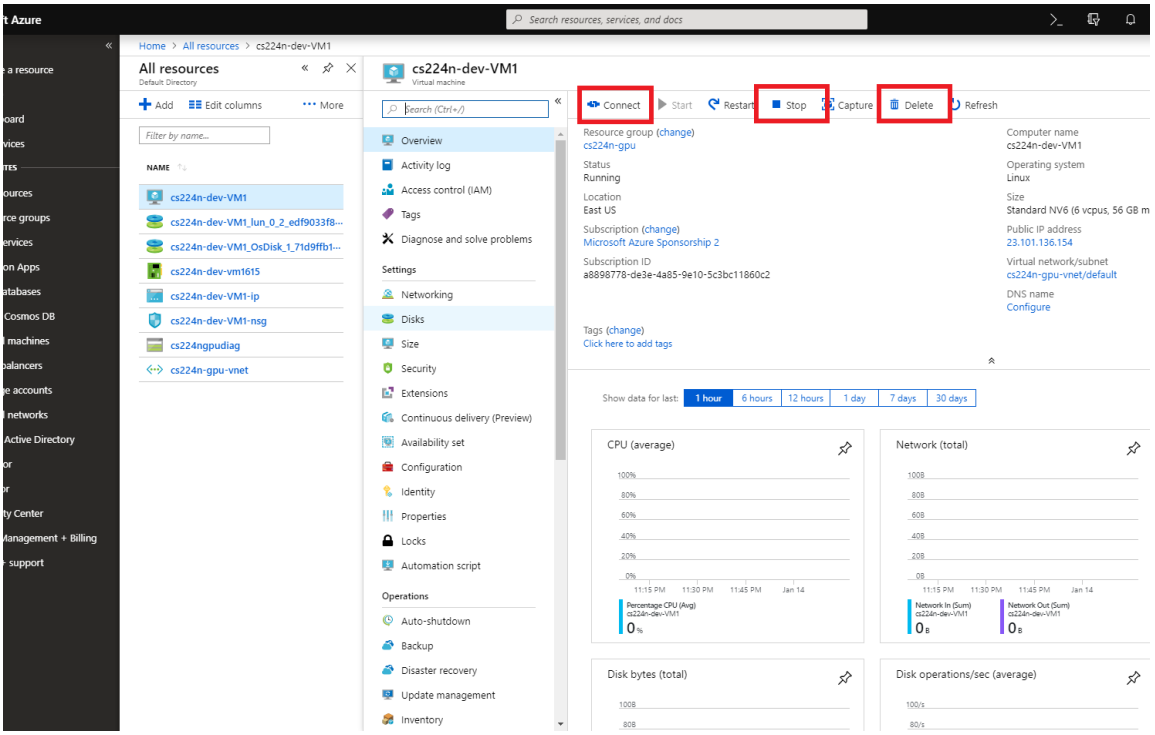


2. Click the name of your VM. You might need to **wait up to 10 minutes** after creating the VM for it to appear on this menu.



3. There are a few important options. Click `Connect` for an ssh command to connect to your instance. Click `Start`/`Stop` to start or stop the instance. If you want to delete the instance, click `Delete`.

   Note that if your instance is stopped but not deleted, it will still accrue charge for storage. (This cost is minimal). Again, ***do not leave your machine running when you are not using it****.*



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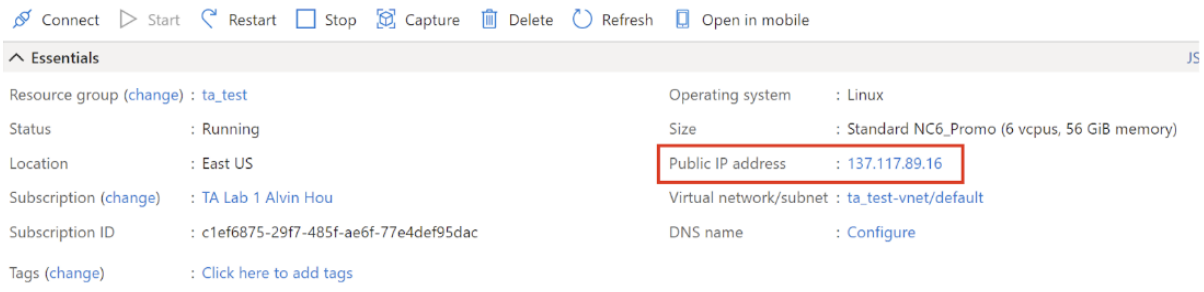
Connecting to a VM

Check out [CS224N: Practical Tips for Using Virtual Machines 2022] for more tips on using Azure.

1. Find the public IP address of your VM



2. Run the following command

```
$ ssh username@<your VM public ip address>
```

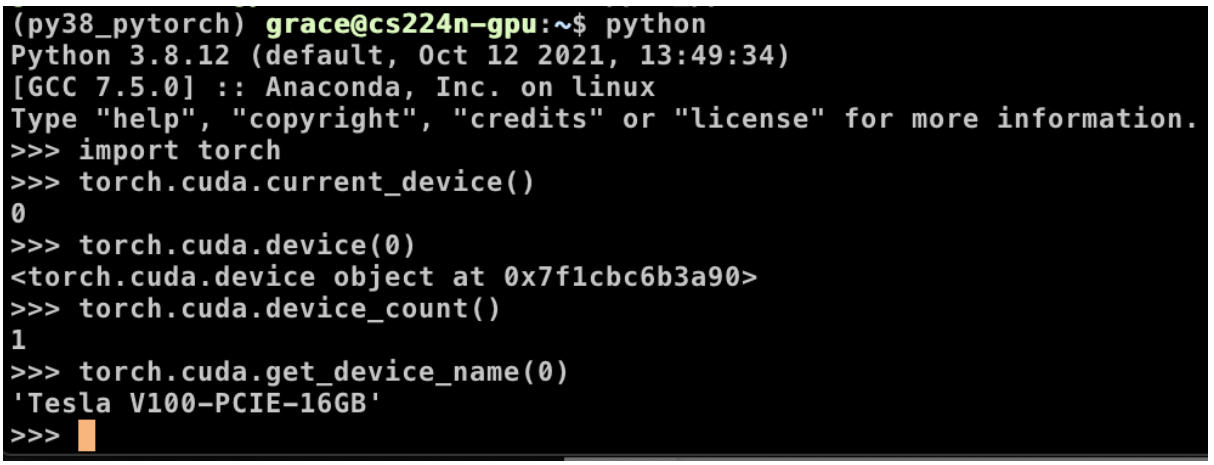
After entering your password, you should see something like this.

```
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-1062-azure x86_64)

  System information as of Tue Feb  1 00:39:57 UTC 2022

  System load:  0.08                Processes:              172
  Usage of /:   52.1% of 145.20GB   Users logged in:        0
  Memory usage: 0%                  IP address for eth0:    10.1.0.4
  Swap usage:   0%                  IP address for docker0: 172.17.0.1

 * Super-optimized for small spaces - read how we shrank the memory
   footprint of MicroK8s to make it the smallest full K8s around.

   https://ubuntu.com/blog/microk8s-memory-optimisation

0 updates can be applied immediately.



The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

*******************************************************************************
* Welcome to the Ubuntu 18.04 Data Science Virtual Machine!                   *
*                                                                             *
* You can access this DSVM, view the graphical desktop with                   *
* X2Go, or run JupyterLab from a browser on your computer                     *
* For more information, see the docs at https://aka.ms/dsvm/docs.             *
*******************************************************************************

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
```

3. Check that Pytorch can access the GPUs by activating the conda environment and opening Python. See the following example

```
$ conda activate azureml_py38
$ python
>>> import torch
>>> torch.cuda.current_device()
>>> torch.cuda.device(0)
>>> torch.cuda.device_count()
```

You should see something like this:



If you see an error message about CUDA, post to Ed for assistance.

FAQs

How do I check my remaining balance?

Go to the Labs under the CS224N Azure page from https://portal.azure.com/#blade/Microsoft_Azure_Education/EducationMenuBlade/overview
Note that Azure bills at midnight every business day, so this figure usually reflects your credit as of the last billing time. Also, note that you will only see your subscription after it is activated. Instructions for activating your subscription(s) is in section *Activate your subscription* above.

How do I share my instances with other students in my group?

For shared subscriptions only, once an instance and user account on that instance has been created using a subscription, all accounts linked to that subscription can see that instance on their dashboard and follow the directions in Using Azure to manage and connect to their VM. Only the subscription created for the final project is shared.

How do I create new user accounts?

If your group feels strongly about using separate user accounts instead of a shared one on your instance, please post privately on Ed.

What happens when I exceed my credit?

Your subscription will be disabled. Please shut down your VM(s) and follow the instructions on Ed.

Can I add a personal credit card to the account?

Sure, though we do not recommend it. If you exhaust the funds from your CS224N subscription, your personal credit card will be charged without warning.

Can I select more powerful instances?

Though we recommend the NC6, you are free to use any of the instances. Just keep in mind that you have a budget!

Appendix

How do I create an SSH key for VM connection?

On your local machine, create SSH key pairs:

- Run `ssh-keygen -m PEM -t rsa -b 4096` (Linux / MacOS)
- Or use the PuTTYgen tool (Windows)

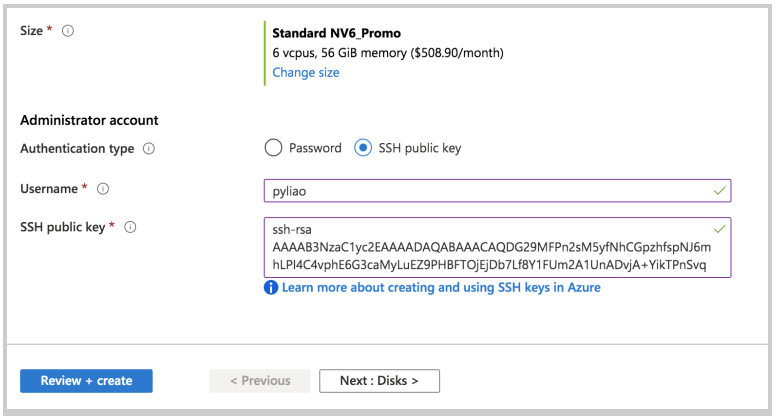
When prompted for a passphrase, either enter a passphrase to secure your private key, or leave it empty.

The public key will be saved to `~/.ssh/id_rsa.pub` by default. The public key looks like:

```
ssh-rsa
AAAAB3NzaC1yc2EAABADAQABAAACAQC1/KanayNr+Q7ogR5mKnGpKWRBQU7F3Jjhn7utdf7Z2i
UFykaYx+MInSnT3XdnBRS8KhC0IP8ptbngIaNOWd6zM8hB6UrcRTlTpwk/SuGMw1Vb40xlEFph
BkVEUgBolOoANIEXriAMvlDMZsgvnMFiQ12tD/u14cxy1WNEMAftey/vX3Fgp2vEq4zHXEliY/
sFZLJUJzcRUI0MOfHXAuCjg/qyqqbIuTDFyfg8k0JTtyGFEMQhbXKcuP2yGx1uw0ice62LRzr8
w0mszftXyMik1PnshRXbmE2xgINYg5xo/ra3mq2imwtOKJpfdtFoMiKhJmSNHBSkK7vFTeYgg0
v2cQ2+vL38lcIFX4Oh+QCzvNF/AXoDVlQtVtSqfQxRVG79Zqio5p12gHFktlfV7reCBvVIhyxc
2LlYUkrq4DHzkxNY5c9OGSHXSle9YsO3F1J5ip18f6gPq4xFmo6dVoJodZm9N0YMKCkZ4k1qJD
ESsJBk2ujDPmQQeMjJX3FnDXYYB182ZCGQzXfzlPDC29cWVgDZEXNHuYrOLmJTmYtLZ4WkdUhL
Llt5XsdoKWqlWpbegyYtGZgeZNRtOOdN6ybOPJqmYFd2qRtb4sYPniGJDOGhx4VodXAjT09omh
QJpE6wlZbRWDvKC55R2d/CSPHJscEiuudb+1SG2uA/oik/WQ== username@domainname
```

Copy this public key, or run: `cat ~/.ssh/id_rsa.pub | pbcopy`

Now in VM creation, choose SSH public key instead of Password in **Authentication type**. Enter your preferred Username. In the SSH public key field, paste the public key you just generated and copied.



Proceed with the remaining process. Now when you login to the VM, you won't be prompted for a password!