### QUESTION 1

1. For **##-Q1** (and all following **##-Qx**) in the Jupyter Notebook DSCI471\_HW4.ipynb:

What line of code you would develop to fulfill the requirement in the code comments "**## import the `Keras` API from TensorFlow**"?

Copy your executed error-free code line to fill in the blank here.

\* Be **careful**for all the **blanks**in this homework:

- Reminder: python is **case sensitive**, so is your answer here to fill in the blank.

- Do not include any extra spaces in front, in between, or in the end of your code line when you fill it in the blank here. In another word, use **EXACT one space**ONLY **when needed**. use **EXACT one space after a comma except if the comma is the last comma in that code line**.  
              e.g. if the expected code line is:  aBc = (12, 34) ,  
                     then an answer     abc       = (     12,34)         (i,e, with more than or less than exact one spaces in each place needed a space, and a lower case letter for which is supposed to be a upper case) will be **WRONG**

\* You may also find some coding **inspirations**from **previous HomeWork** assignments



**10 points**

### QUESTION 2

1. For **##-Q2**

What line of code you would develop to fulfill the requirement in the code comments "**## import the namespace "layers" and "optimizer" of Keras from Tensorflow** "?

Copy your executed error-free code line to fill in the blank here.



**10 points**

### QUESTION 3

1. For **##-Q3**:

What are the code you would fill in the ???s in the code line     loaded\_image\_samples = ???[:???]   to fulfill its requirements in the code comment (i.e .show first 6 images in the loaded data, i.e. images\_train)?

Please fill in the blank with EXACT characters or numbers you've executed error-free:   loaded\_image\_samples = images\_train[:6]

Please fill in each blank without any comma or space, e.g.  xxx   instead of    xxx       .

loaded\_image\_samples = [**:**]

**10 points**

### QUESTION 4

1. For **##-Q4**:

What are the code you would fill in the ???s in the code line    images = images.reshape(???, ???, ???, ???).astype('float32')     to fulfill its requirements in the code comment (i.e .reshape origianl dimension of images\_train  to a new dimension by adding a color channel for its grayscale color )?

Please fill in the blank with EXACT number vlaues you've executed error-free:      images = images.reshape(len(images), 28, 28, 1).astype('float32')

Please fill in each blank without any comma or space, e.g.  xxx   instead of    xxx        .

images = images.reshape(, , , ).astype('float32')

**10 points**

### QUESTION 5

1. For **##-Q5**:

What are the code you would fill in the ???s in the code line      images\_preprocessed = ???(???)      to fulfill its requirements in the code comment (i.e. Use the function images\_preprocess to preprocess the loaded data `images\_train`)?

Please fill in the blank with EXACT charactors you've executed error-free:      images\_preprocessed = images\_preprocess(images\_train)

Please fill in each blank without any comma or space, e.g.  xxx   instead of    xxx        .

images\_preprocessed = ()

**10 points**

### QUESTION 6

1. For **##-Q6**:

What is the function name you would fill in the ??? in the code line       generator = keras.???([ ...      
to fulfill its requirements in the code comment (i.e. to **Build a Generator model by stacking keras layers sequentially**)?

Please fill in the blank with EXACT charactors with case-sensitivity that you've executed error-free:     generator = keras.Sequential([ ...

Please fill in each blank without any comma or space, e.g.  xXx   instead of    xXx        .

generator = keras.([ ...  
  ...  
  ...  
])

**5 points**

### QUESTION 7

1. For **##-Q7**:

What are the code you would fill in the ??? in the code line         ???.???(7\*7\*128, input\_shape=(NOISE\_SIZE,), use\_bias=???),       
to fulfill its requirements in the code comment (i.e. ## Apply a **fully-connected** layer **WITH** **bias**, to receive and feature mapping the input, i.e. the noice vector) ?

Please fill in the blank with EXACT charactors with ***case-sensitivity*** that you've executed error-free:       layers.Dense(7\*7\*128, input\_shape=(NOISE\_SIZE,), use\_bias=True),

Please fill in each blank without any comma or space, e.g.  xXx   instead of    xXx        .

.(7\*7\*128, input\_shape=(NOISE\_SIZE,), use\_bias=),

**10 points**

### QUESTION 8

1. For **##-Q8**:

What is the function name you would fill in the ??? in the code line        layers.Conv2DTranspose(64, (???, ???), strides=(???, ???), padding='???', use\_bias=???),   
to fulfill its requirements in the code comment (i.e.  
    ## Build a Transposed Convolution layer **WITHOUT**bias   
    ##      to do inversed convolution as a way to do learnable Upsampling;  
    ##   which has number of filters that equals to HALF of the feature dimension of the output from previous layer;   
    ##   **5 X 5**as the kernel size;  
    ##   stride step as **2** for all of its spatial dimensions; and   
    ##   **padding**with zeros evenly to the **surroundings**of the input.   
) ?

Please fill in the blank with EXACT charactors and numbers that you've executed error-free:      layers.Conv2DTranspose(64, (5, 5), strides=(2, 2), padding='same', use\_bias=False),

Please fill in each blank without any comma or space, e.g.  xxx   instead of    xxx        .

layers.Conv2DTranspose(64, (, ), strides=(, ), padding='', use\_bias=),

**15 points**

### QUESTION 9

1. For **##-Q9**:

After **upsampling**by the first transposed convolution layer  
with the required parameter configurations:

What is the current dimension of the 2D latent image, that **was**7X7 as output from previous Reshape layer? 

Please fill in the blank with your answer to the similar pattern as: aXb (i.e. replace the 'a' and 'b' with the actual number values;  no space involved anywhere in your answer and use only pure digit number)



**5 points**

### QUESTION 10

1. For **##-Q10:**

What line of code you would develop to fulfill the requirement in the code comments, i.e.

"   ## Build a **transposed convolution** layer **WITHOUT**bias;  
    ##   which has number of **filters**that equals to **HALF of**the feature dimension of the output from ***previous transposed convolution*** layer;   
    ##   3 X 3 as the **kernel size**;   
    ##   **stride**step as 2 for all of its spatial dimensions; and   
    ##   **padding**with zeros evenly to the surroundings of the input.

"?

Copy your executed error-free code line (**all code** in this line, **including**the last comma) to fill in the blank here, for example:

layers.Conv2DTranspose(32, (3, 3), strides=(2, 2), padding='same', use\_bias=False),

Please write in the blank with EXACT charactors with **case-sensitivity** and pure number digit that you've executed error-free  
Please use **EXACT one space** in each place that needed a space, and use EXACT one space after a comma, except if the comma is the last comma in that code line.



**10 points**

### QUESTION 11

1. For **##-Q11**:

What are the code that you have put in place of the 1st,2nd,3rd and 6th ???  in the code line     layers.Conv2DTranspose(???, (3, 3), strides=(???, ???), padding='???', use\_bias=???, activation='???'),   
to fulfill its requirements in the code comment (i.e.  
    ## Build a transposed convolution layer WITHOUT bias;  
    ##   which has a number of **filters** that would make the **output**, i.e. the generated image, to **have only 1 feature dimension**, i.e. **1 color channel for the generated grayscale image**  
    ##   3 X 3 as the kernel size;   
    ##   SET **stride**step as a PROPER number **that would make** the output, i.e. the generated image, to have its first 2 dimensions (i.e. height and width), same as the loaded mnist real image.  i.e. **the generated output image** from Generator**in image size 'a'X'b'** **same**as a **real image**.          
    ##   padding with zeros evenly to the surroundings of the input;  
    ##   and CHOOSE an **activation**function that **could make the range of output** fake image's pixel values the SAME as preprocessed real iamge. i.e. **in** a **range in [-1, 1]**    
) ?

Please fill in the blank with EXACT charactors and numbers that you've executed error-free:     layers.Conv2DTranspose(1, (3, 3), strides=(1, 1), padding='same', use\_bias=False, activation='tanh'),

Please fill in each blank without any comma or space, e.g.  xxx   instead of    xxx        .

layers.Conv2DTranspose(, (3, 3), strides=(, ), padding='same', use\_bias=False, activation=''),

**20 points**

### QUESTION 12

1. For **##-Q12:**

What line of code you would develop to fulfill the requirement in the code comments, i.e.

"   ## Build a **Convolutional**layer that   
    ##   `input\_shape` equal to the image dimention,    
    ##   has 64 **filters**,   
    ##   5 X 5 as the **kernel**size,   
    ##   **stride**step as 2,and   
    ##   **padding**with zeros evenly to the surroundings of the input.

"?

Copy your executed error-free code line (**all code** in this line, including the last comma) to fill in the blank here, for example:

layers.Conv2D(64, (5, 5), strides=(2, 2), input\_shape=image\_dim, padding='same'),

Please write in the blank with EXACT charactors with **case-sensitivity** and pure number digit that you've executed error-free  
Please use **EXACT one space** in each place that needed a space, and use EXACT one space after a comma, except if the comma is the last comma in that code line.



### QUESTION 13

1. For **##-Q13:**

What line of code you would develop to fulfill the requirement in the code comments, i.e.

"   ## Biuld **A Flatten layer** to flatten the input  "?

Copy your executed error-free code line (**all code** in this line, including the last comma) to fill in the blank here.

Please write in the blank with EXACT charactors with **case-sensitivity** that you've executed error-free  
Please use NO **space** anywhere in this line of code, not in parenthsis as well.



### QUESTION 14

1. For **##-Q14**:

What are the code that you have put in place of the  2nd,3rd and 4th ???  in the code line       ???.???(units=???, activation='???')      
to fulfill its requirements in the code comment (i.e.  
    ## Apply a `**full-connected**` output layer with a unit number that can **output a binary value**;  
    ##   - choose a **proper activation** function**for this goal of binary output**(binary classification task)  
) ?

Please fill in the blank with EXACT case-sensitive charactors and numbers that you've executed error-free:     layers.Dense(units=1, activation='sigmoid')

Please fill in each blank without any comma or space, e.g.  xxx   instead of    xxx        .

layers.(units=, activation='')

### QUESTION 15

1. For **##-Q15**:

What are the code you would fill in the 1st and 2nd ???s in the code line    my\_optimizer = ???.???(learning\_rate=???) to fulfill its requirements in the comment (i.e .Select an optimizer that implements the Adam algorithm in a learning rate that you tunned as a proper value)?

Please fill in the blank with EXACT case-sensitive characters you've executed error-free:   my\_optimizer = optimizers.Adam(learning\_rate=0.001)

Please fill in the blank without any comma or space, e.g.  xxx.xxx   instead of    xxx .  xxx .

my\_optimizer = .(learning\_rate=0.001)

### QUESTION 16

1. for **##-Q16**:

What are the values you should fill in the blank for the below code to fulfill the requirements of compiling your Discriminator model with your optimizer and **Binary cross-entropy as losses** (since the Discriminator in this DCGAN is conducting abinary classification task) ?

.(  
    optimizer=my\_optimizer,  
    loss=keras..()  
)

\* fill in the blank exactly as you developed in replacing the ??? in the notebook, which case-sensitive charactors and contains no extra comma or spaces.

\* You could always refer to the provided clickable links in section description of the Notebook above the code cell for more on the **syntaxes**from the **API documentaions**

**15 points**

### QUESTION 17

1. For **##-Q17**:

How many parameters in total have been learned druing your model training?

What is the `**total number**` of params (i.e. weights) , **including the Non-trainable** params e.g. from the Discriminator part, in the whole DCGAN Model build above?  
be careful in the calculations, For example. with or without bias.

Please fill without any spaces, comma, or characters



**5 points**

### QUESTION 18

1. For **##-Q18**:

What is the code line you developed to **set Discriminator Not-trainable** before training the whole DCGAN.

Please copy your executable error-free code to fill in the blank and use only exact one space when it is needed.



### QUESTION 19

1. For **##-Q19**:

What are the code you would fill in the 1st and 2nd ???s in the code line     dcg\_loss = dcgan.???(???, ???)     
to fulfill its requirements in the comment (i.e .  
        ## **Batch Train** DCGAN Model **on a batch of noise inputs** with them **labeled as real**  
        ##   to fool the Discriminator with the fake images generated by Generator but labeled as real  
)?

Please fill in the blank with EXACT case-sensitive characters you've executed error-free:     dcg\_loss = dcgan.train\_on\_batch(noise\_inputs, labels\_real)

Please fill in the blank without any comma or space, e.g.  xxx.xxx   instead of    xxx .  xxx .

dcg\_loss = dcgan.(, )

### QUESTION 20

\* Reminder, you need to**tune your model** by adjusting the values of hyperparameters such as learning rate and epochs to generate satisfied fake images.

**Copy**your final settings of the **hyperparameters**from the tunned code, for example:

**Tuned Hyperparameters:**

learning\_rate = 0.001

EPOCHS = 4

And make any comments about your completion in this assignment (e.g. what do you think the 6 numbers are in the generated fake image eventually, what is the final iteration number, are you satisfied the result, what's your most impressive gaining/learning from this experience etc. )

|  |
| --- |
| For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).  Paragraph  Arial  10pt  The six numbers in the generated fake images are 5, 4, 8, 1, 9, 2. The final iteration number was 2700. The most impressive thing to learn was GANs  ability to generate new and quite realistic images that resemble the actual ones. This will help in future and open ups exciting possibilities  for generating synthetic data when actual data is scarce or unavailable.  0 WORDS[POWERED BY TINY](https://www.tiny.cloud/?utm_campaign=editor_referral&utm_medium=poweredby&utm_source=tinymce&utm_content=v5) |

### QUESTION 21

1. **Submit here**

your **completed** and **executed**Notebook (**with all the outputs** remains inluding the plots), and

has the Notebook named as **DSCI471\_HW4\_yourDrexelID.ipynb**

Attach File



Bottom of Form