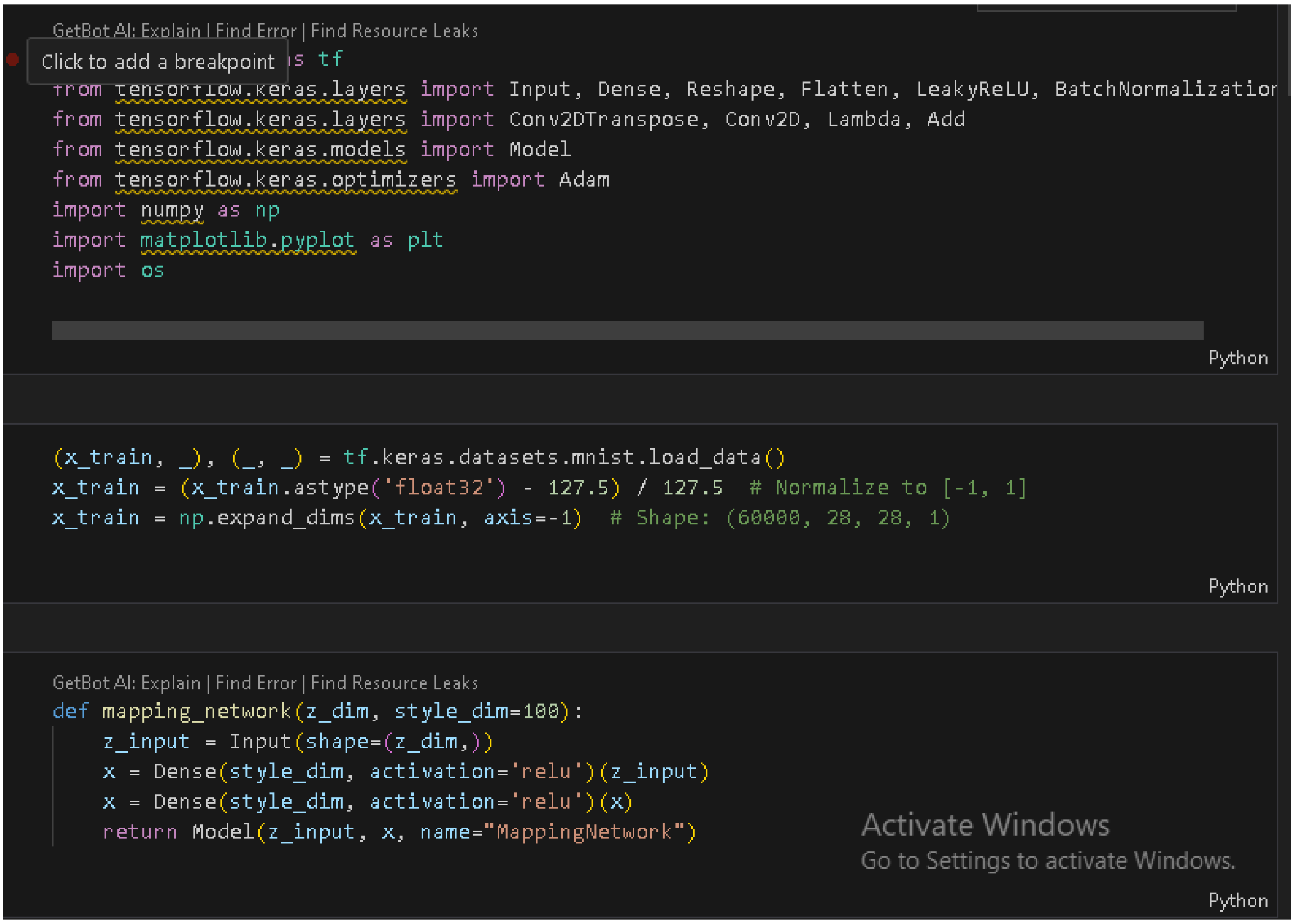
	Marwadi University **Faculty of Engineering and Technology** **Department of Information and Communication Technology**	
Subject: Gen AI	**Write a code for STYLE GAN. USE DATASET MNIST FROM KERAS**	
Experiment	**Date:**	**Enrolment No:92200133020**

CODE:



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```
                 s tf
from tensorflow.keras.layers import Input, Dense, Reshape, Flatten, LeakyReLU, BatchNormalizatior
from tensorflow.keras.layers import Conv2DTranspose, Conv2D, Lambda, Add
from tensorflow.keras.models import Model
from tensorflow.keras.optimizers import Adam
import numpy as np
import matplotlib.pyplot as plt
import os
```

```
(x_train, _), (_, _) = tf.keras.datasets.mnist.load_data()
x_train = (x_train.astype('float32') - 127.5) / 127.5  # Normalize to [-1, 1]
x_train = np.expand_dims(x_train, axis=-1)  # Shape: (60000, 28, 28, 1)
```

```
def mapping_network(z_dim, style_dim=100):
    z_input = Input(shape=(z_dim,))
    x = Dense(style_dim, activation='relu')(z_input)
    x = Dense(style_dim, activation='relu')(x)
    return Model(z_input, x, name="MappingNetwork")
```

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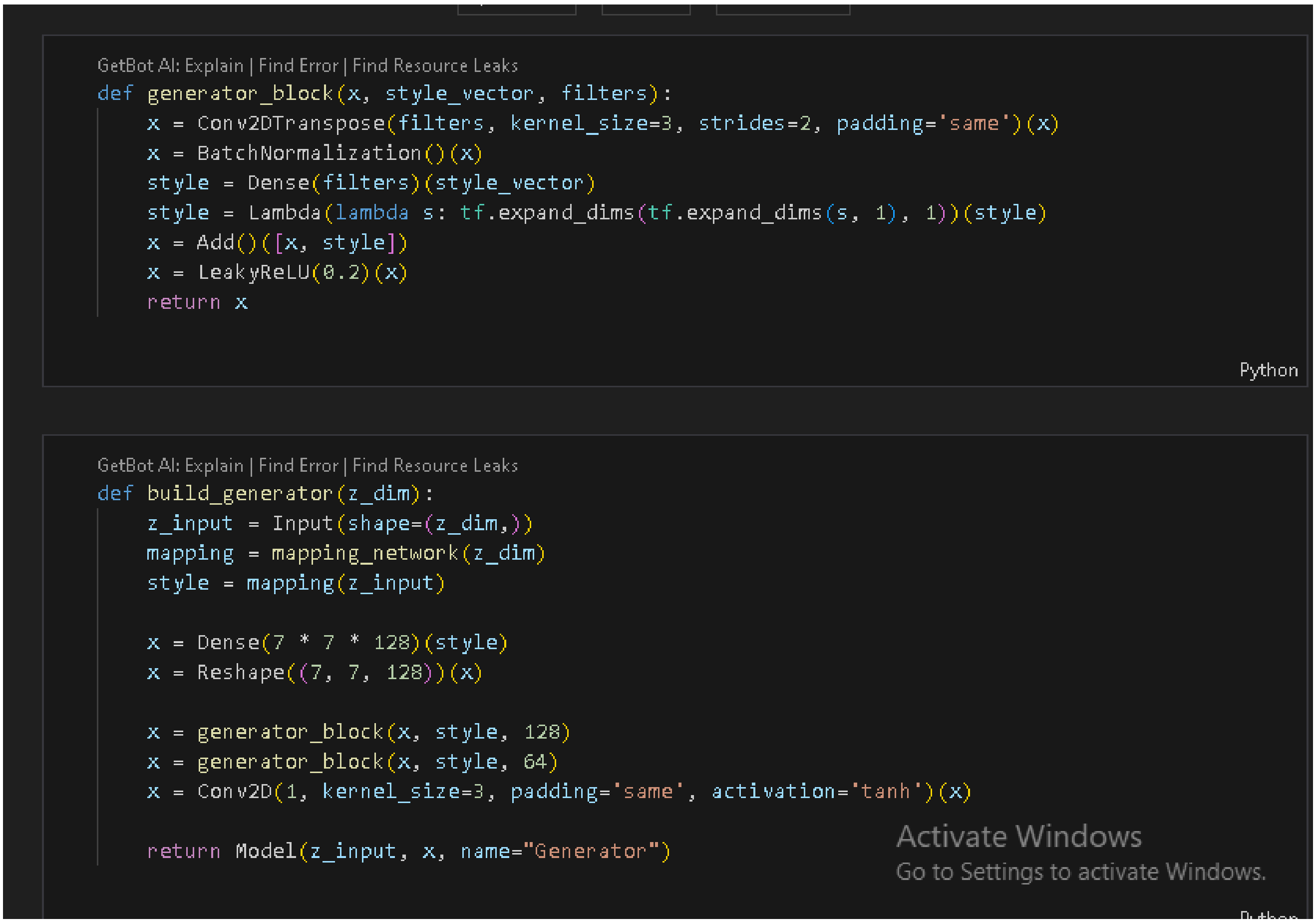

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```python
def generator_block(x, style_vector, filters):
    x = Conv2DTranspose(filters, kernel_size=3, strides=2, padding='same')(x)
    x = BatchNormalization()(x)
    style = Dense(filters)(style_vector)
    style = Lambda(lambda s: tf.expand_dims(tf.expand_dims(s, 1), 1))(style)
    x = Add()([x, style])
    x = LeakyReLU(0.2)(x)
    return x
```

Python
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```python
def build_generator(z_dim):
    z_input = Input(shape=(z_dim,))
    mapping = mapping_network(z_dim)
    style = mapping(z_input)

    x = Dense(7 * 7 * 128)(style)
    x = Reshape((7, 7, 128))(x)

    x = generator_block(x, style, 128)
    x = generator_block(x, style, 64)
    x = Conv2D(1, kernel_size=3, padding='same', activation='tanh')(x)

    return Model(z_input, x, name="Generator")
```

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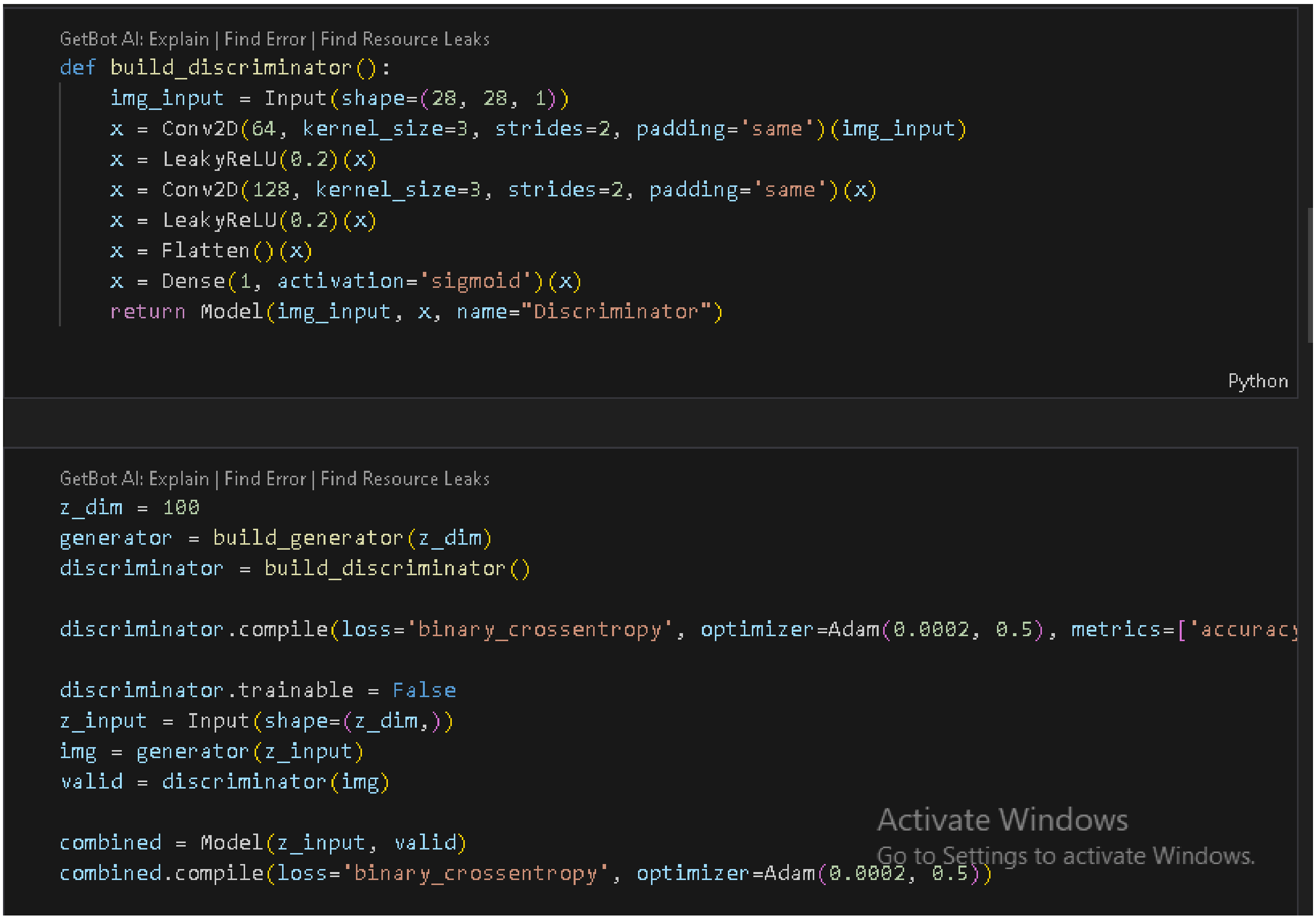

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```python
def build_discriminator():
    img_input = Input(shape=(28, 28, 1))
    x = Conv2D(64, kernel_size=3, strides=2, padding='same')(img_input)
    x = LeakyReLU(0.2)(x)
    x = Conv2D(128, kernel_size=3, strides=2, padding='same')(x)
    x = LeakyReLU(0.2)(x)
    x = Flatten()(x)
    x = Dense(1, activation='sigmoid')(x)
    return Model(img_input, x, name="Discriminator")
```

Python
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```python
z_dim = 100
generator = build_generator(z_dim)
discriminator = build_discriminator()

discriminator.compile(loss='binary_crossentropy', optimizer=Adam(0.0002, 0.5), metrics=['accuracy

discriminator.trainable = False
z_input = Input(shape=(z_dim,))
img = generator(z_input)
valid = discriminator(img)

combined = Model(z_input, valid)
combined.compile(loss='binary_crossentropy', optimizer=Adam(0.0002, 0.5))
```

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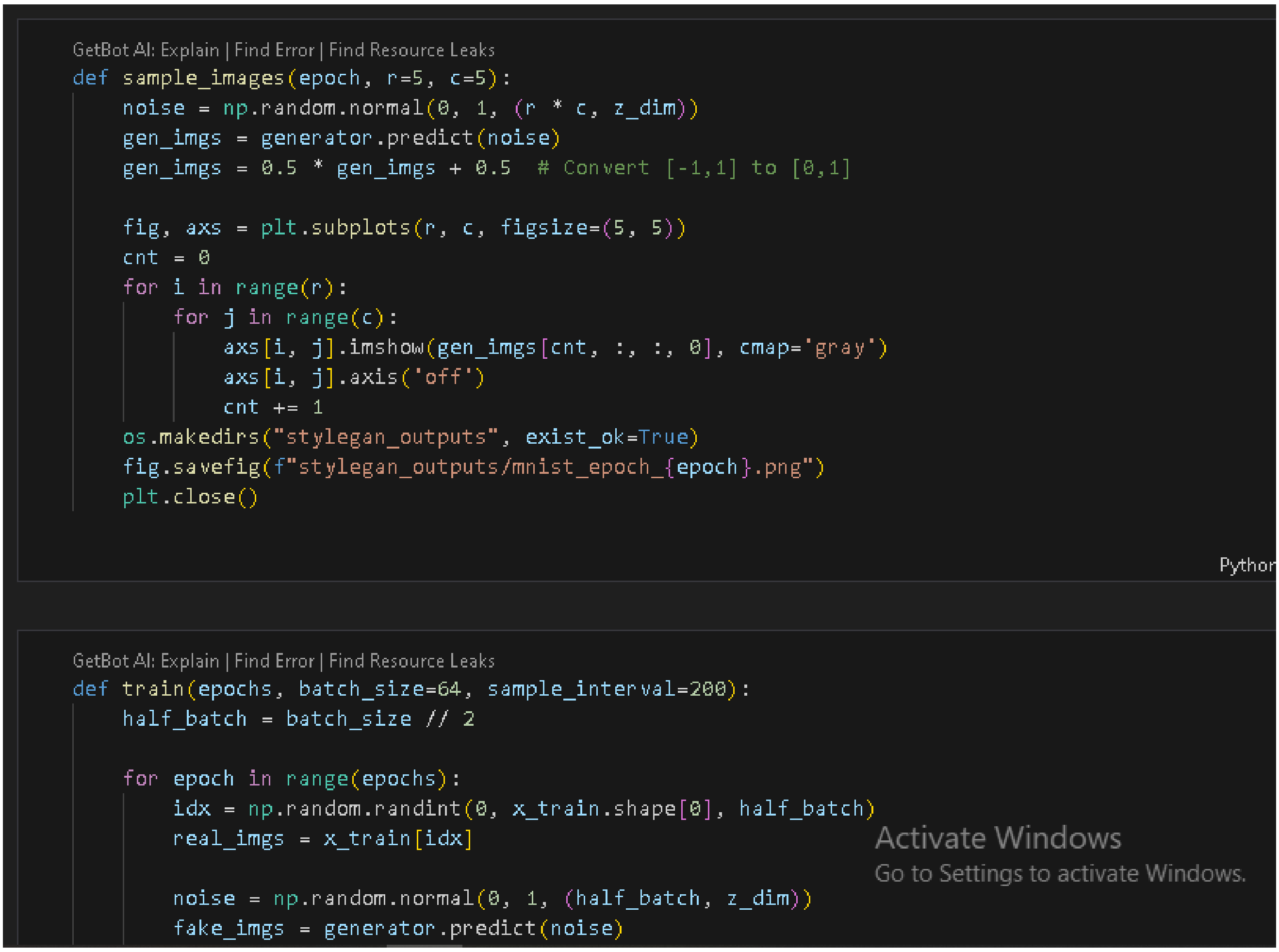
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```
def sample_images(epoch, r=5, c=5):
    noise = np.random.normal(0, 1, (r * c, z_dim))
    gen_imgs = generator.predict(noise)
    gen_imgs = 0.5 * gen_imgs + 0.5  # Convert [-1,1] to [0,1]

    fig, axs = plt.subplots(r, c, figsize=(5, 5))
    cnt = 0
    for i in range(r):
        for j in range(c):
            axs[i, j].imshow(gen_imgs[cnt, :, :, 0], cmap='gray')
            axs[i, j].axis('off')
            cnt += 1
    os.makedirs("stylegan_outputs", exist_ok=True)
    fig.savefig(f"stylegan_outputs/mnist_epoch_{epoch}.png")
    plt.close()
```

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```
def train(epochs, batch_size=64, sample_interval=200):
    half_batch = batch_size // 2

    for epoch in range(epochs):
        idx = np.random.randint(0, x_train.shape[0], half_batch)
        real_imgs = x_train[idx]

        noise = np.random.normal(0, 1, (half_batch, z_dim))
        fake_imgs = generator.predict(noise)
```

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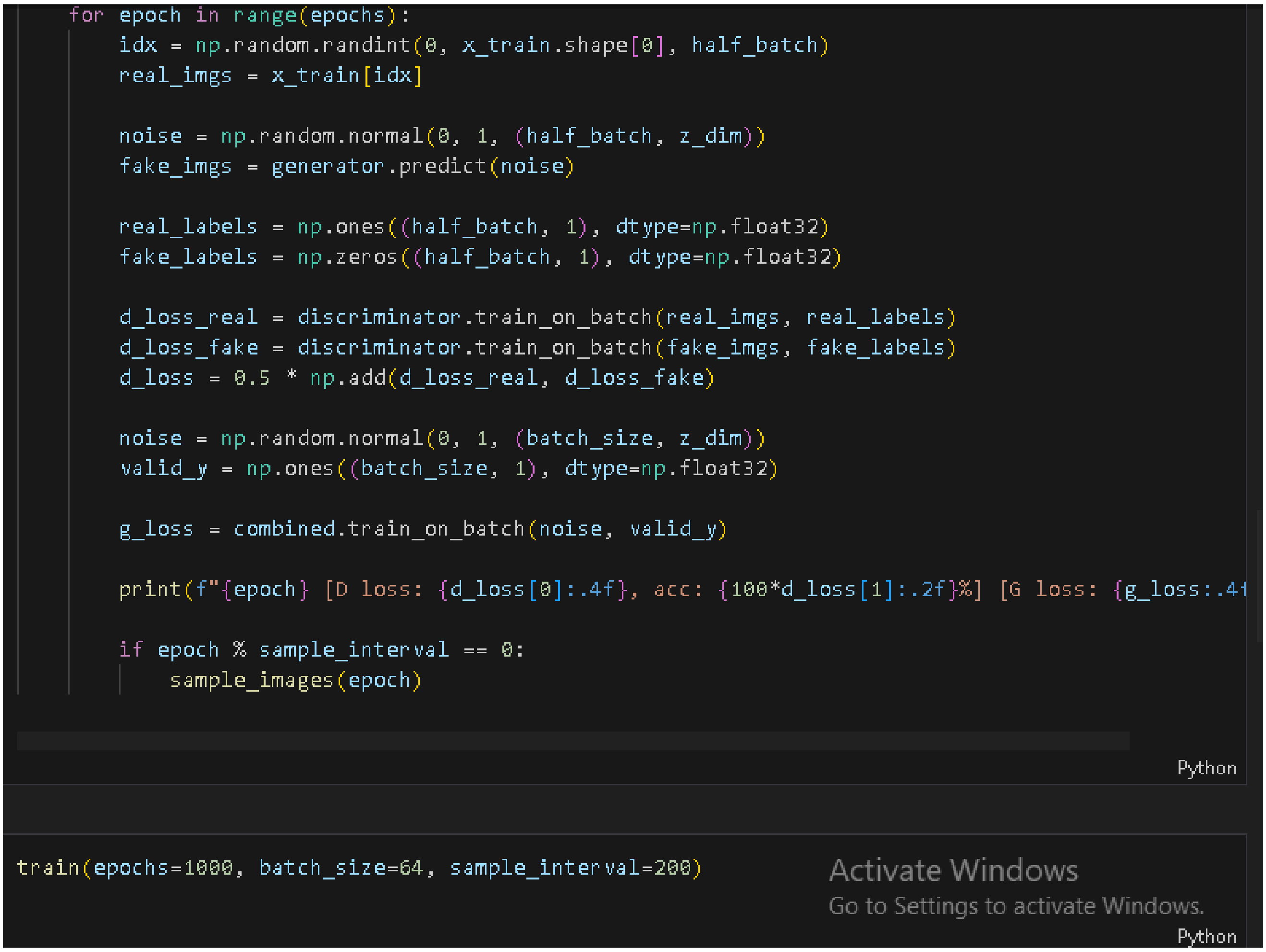

```python
    for epoch in range(epochs):
        idx = np.random.randint(0, x_train.shape[0], half_batch)
        real_imgs = x_train[idx]

        noise = np.random.normal(0, 1, (half_batch, z_dim))
        fake_imgs = generator.predict(noise)

        real_labels = np.ones((half_batch, 1), dtype=np.float32)
        fake_labels = np.zeros((half_batch, 1), dtype=np.float32)

        d_loss_real = discriminator.train_on_batch(real_imgs, real_labels)
        d_loss_fake = discriminator.train_on_batch(fake_imgs, fake_labels)
        d_loss = 0.5 * np.add(d_loss_real, d_loss_fake)

        noise = np.random.normal(0, 1, (batch_size, z_dim))
        valid_y = np.ones((batch_size, 1), dtype=np.float32)

        g_loss = combined.train_on_batch(noise, valid_y)

        print(f"{epoch} [D loss: {d_loss[0]:.4f}, acc: {100*d_loss[1]:.2f}%] [G loss: {g_loss:.4

        if epoch % sample_interval == 0:
            sample_images(epoch)
```

```python
train(epochs=1000, batch_size=64, sample_interval=200)
```

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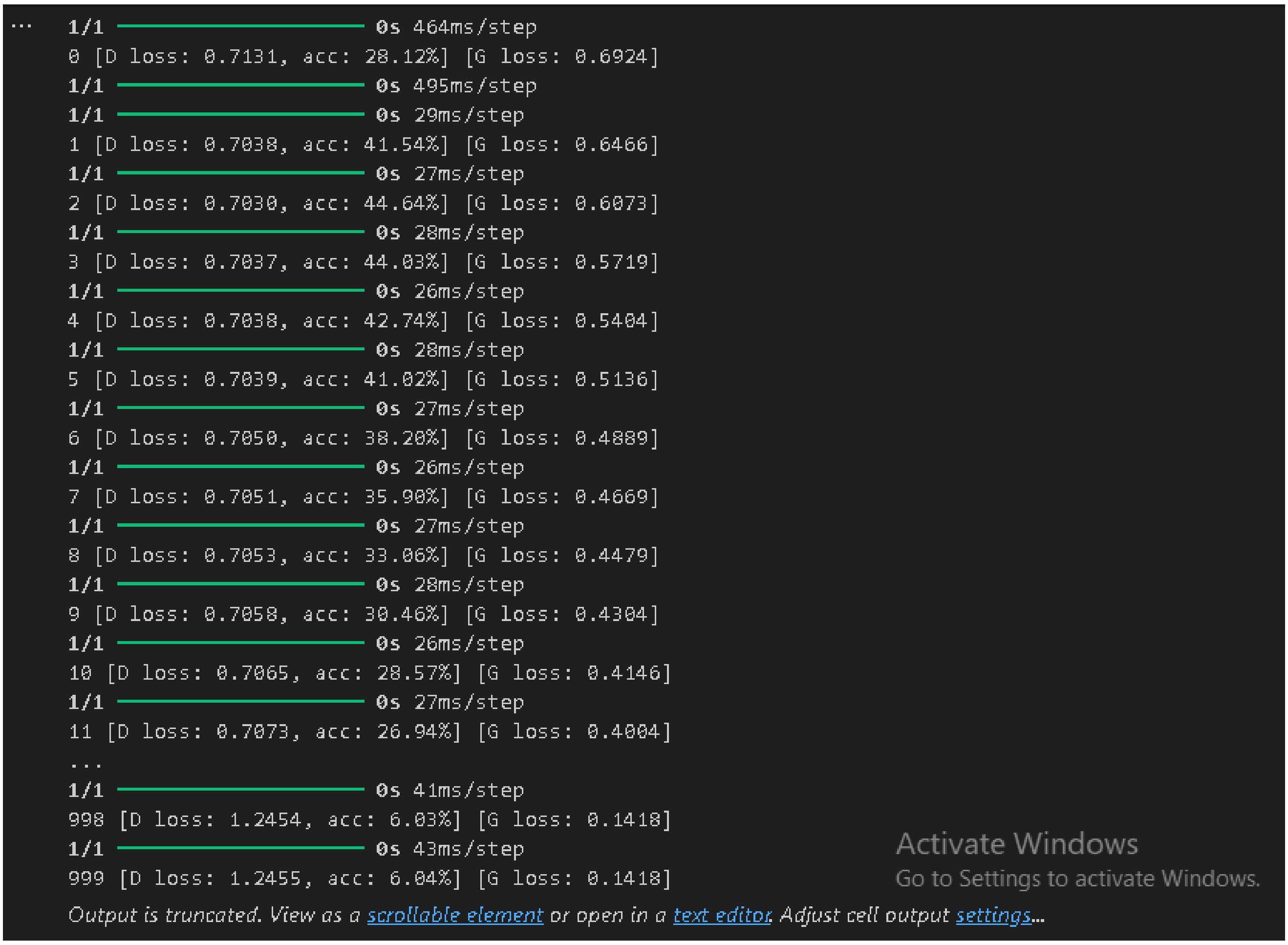

```
...  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 464ms/step
     0 [D loss: 0.7131, acc: 28.12%] [G loss: 0.6924]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 495ms/step
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step
     1 [D loss: 0.7038, acc: 41.54%] [G loss: 0.6466]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
     2 [D loss: 0.7030, acc: 44.64%] [G loss: 0.6073]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 28ms/step
     3 [D loss: 0.7037, acc: 44.03%] [G loss: 0.5719]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 26ms/step
     4 [D loss: 0.7038, acc: 42.74%] [G loss: 0.5404]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 28ms/step
     5 [D loss: 0.7039, acc: 41.02%] [G loss: 0.5136]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
     6 [D loss: 0.7050, acc: 38.20%] [G loss: 0.4889]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 26ms/step
     7 [D loss: 0.7051, acc: 35.90%] [G loss: 0.4669]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
     8 [D loss: 0.7053, acc: 33.06%] [G loss: 0.4479]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 28ms/step
     9 [D loss: 0.7058, acc: 30.46%] [G loss: 0.4304]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 26ms/step
     10 [D loss: 0.7065, acc: 28.57%] [G loss: 0.4146]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
     11 [D loss: 0.7073, acc: 26.94%] [G loss: 0.4004]
     ...
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 41ms/step
     998 [D loss: 1.2454, acc: 6.03%] [G loss: 0.1418]
     1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 43ms/step
     999 [D loss: 1.2455, acc: 6.04%] [G loss: 0.1418]
```

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