Q1: Step 01

```
from google.colab import files

# Upload the image
uploaded = files.upload()
```

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving Question 1.jpg to Question 1 (1).jpg

Load and Displaying the image

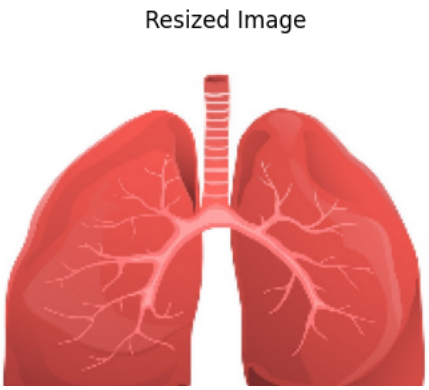
```
import cv2
from matplotlib import pyplot as plt
import matplotlib.image as mpimg

# Get the filename of the uploaded image
filename = list(uploaded.keys())[0]

# Load the image using OpenCV
image = cv2.imread(filename)

# Display the original image
plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB))
plt.title('Original Image')
plt.axis('off')
plt.show()
```

Resizing the image

```
# Define the desired size
fixed_size = (300, 200)

# Resize the image
resized_image = cv2.resize(image, fixed_size)
```

Displaying resized image

```
# Display the resized image
plt.imshow(cv2.cvtColor(resized_image, cv2.COLOR_BGR2RGB))
plt.title('Resized Image')
plt.axis('off')
plt.show()
```



Saving the resized image

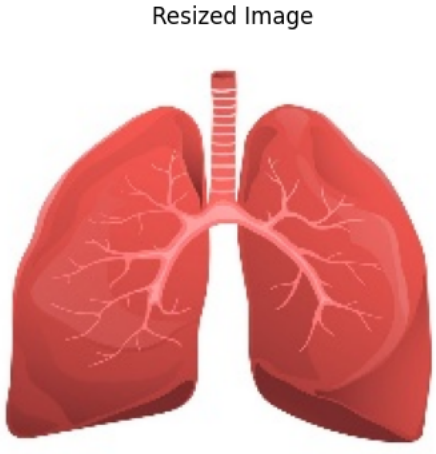
```
# Save the resized image
cv2.imwrite('resized_image.jpg', resized_image)
```

```
True
```

Step 2

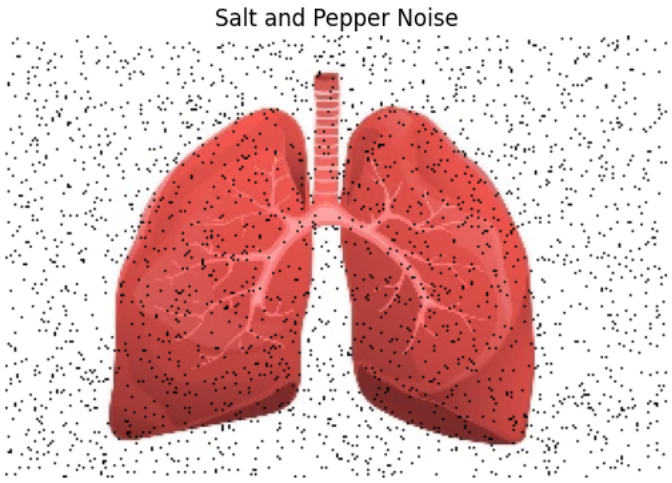
Loading reszed image

```
import cv2
from matplotlib import pyplot as plt

# Load the resized image
resized_image = cv2.imread('resized_image.jpg')
resized_image = cv2.cvtColor(resized_image, cv2.COLOR_BGR2RGB)

# Display the resized image
plt.imshow(resized_image)
plt.title('Resized Image')
plt.axis('off')
plt.show()
```



Salt and Pepper Noise (for grayscale images):

```
import numpy as np

def add_salt_and_pepper_noise(image, salt_prob, pepper_prob):
    noisy_image = np.copy(image)

    # Add salt noise
    salt_pixels = np.random.random(image.shape[:2])
    noisy_image[salt_pixels < salt_prob] = 1.0

    # Add pepper noise
    pepper_pixels = np.random.random(image.shape[:2])
    noisy_image[pepper_pixels < pepper_prob] = 0.0

    return noisy_image

# Specify probabilities for salt and pepper noise
salt_prob = 0.02
pepper_prob = 0.02

# Apply salt and pepper noise
noisy_image_salt_pepper = add_salt_and_pepper_noise(resized_image, salt_prob, pepper_prob)

# Display the image with salt and pepper noise
plt.imshow(noisy_image_salt_pepper)
plt.title('Salt and Pepper Noise')
plt.axis('off')
plt.show()
```



Speckle Noise (for grayscale images):

```
def add_speckle_noise(image, variance):
    row, col, ch = image.shape
    gauss = np.random.randn(row, col, ch)
    noisy = image + image * gauss * variance
    return noisy

# Specify variance for speckle noise
speckle_variance = 0.05

# Apply speckle noise
noisy_image_speckle = add_speckle_noise(resized_image, speckle_variance)

# Display the image with speckle noise
plt.imshow(np.clip(noisy_image_speckle, 0, 1))  # Ensure values are in the valid range [0, 1]
plt.title('Speckle Noise')
plt.axis('off')
plt.show()
```

Speckle Noise

Random Noise (for grayscale images):

```
def add_random_noise(image, noise_level):
    noisy_image = image + noise_level * np.random.normal(size=image.shape)
    noisy_image = np.clip(noisy_image, 0, 1)
    return noisy_image

# Specify noise level for random noise
random_noise_level = 0.05

# Apply random noise
noisy_image_random = add_random_noise(resized_image, random_noise_level)

# Display the image with random noise
plt.imshow(noisy_image_random)
plt.title('Random Noise')
plt.axis('off')
plt.show()
```

Random Noise

Gaussian Noise (for grayscale images):

```
def add_gaussian_noise(image, mean, sigma):
    row, col, ch = image.shape
    gauss = np.random.normal(mean, sigma, (row, col, ch))
    noisy = image + gauss

    # Clip values to the valid range [0, 1]
    noisy = np.clip(noisy, 0, 1)

    return noisy

# Specify mean and standard deviation for Gaussian noise
gaussian_mean = 0
gaussian_sigma = 0.1

# Apply Gaussian noise
noisy_image_gaussian = add_gaussian_noise(resized_image, gaussian_mean, gaussian_sigma)

# Display the image with Gaussian noise
plt.imshow(noisy_image_gaussian)
plt.title('Gaussian Noise')
plt.axis('off')
plt.show()
```

Gaussian Noise

Saving noisy image

```
# Assuming noisy_image_speckle is the image with speckle noise
noisy_image_speckle_uint8 = (noisy_image_speckle * 255).astype(np.uint8)

# Save the image
cv2.imwrite('noisy_image_speckle.jpg', cv2.cvtColor(noisy_image_speckle_uint8, cv2.COLOR_RGB2BGR))
```

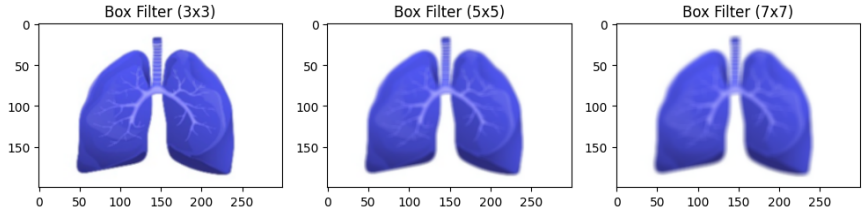
```
True
```

Step3

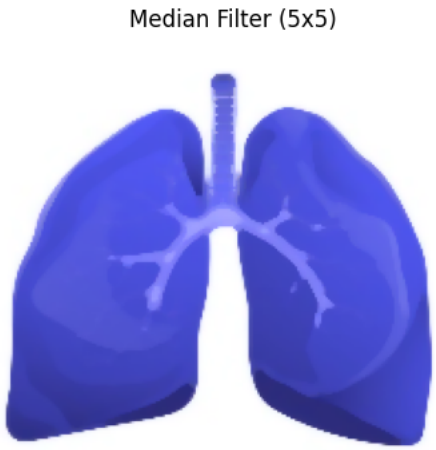
```
import cv2
from matplotlib import pyplot as plt

# Load the resized image
resized_image = cv2.imread('resized_image.jpg')
resized_image_rgb = cv2.cvtColor(resized_image, cv2.COLOR_BGR2RGB)

# Display the resized image
plt.imshow(resized_image_rgb)
plt.title('Resized Image')
plt.axis('off')
plt.show()
```

Resized Image

```
# Apply box filter with different kernel sizes
box_filtered_3x3 = cv2.boxFilter(resized_image, -1, (3, 3))
box_filtered_5x5 = cv2.boxFilter(resized_image, -1, (5, 5))
box_filtered_7x7 = cv2.boxFilter(resized_image, -1, (7, 7))

# Display the box-filtered images
plt.figure(figsize=(10, 5))
plt.subplot(131), plt.imshow(box_filtered_3x3), plt.title('Box Filter (3x3)')
plt.subplot(132), plt.imshow(box_filtered_5x5), plt.title('Box Filter (5x5)')
plt.subplot(133), plt.imshow(box_filtered_7x7), plt.title('Box Filter (7x7)')
plt.tight_layout()
plt.show()
```

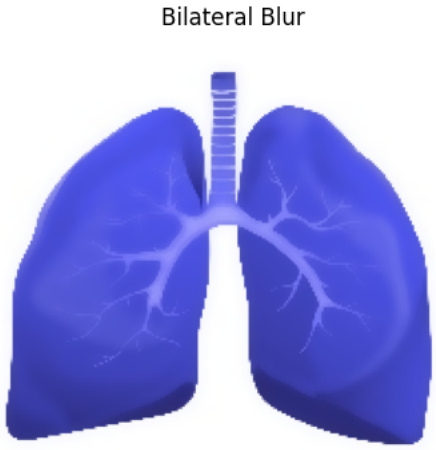



```
# Apply median filter
median_filtered = cv2.medianBlur(resized_image, 5)  # Kernel size is 5x5

# Display the median-filtered image
plt.imshow(median_filtered)
plt.title('Median Filter (5x5)')
plt.axis('off')
plt.show()
```

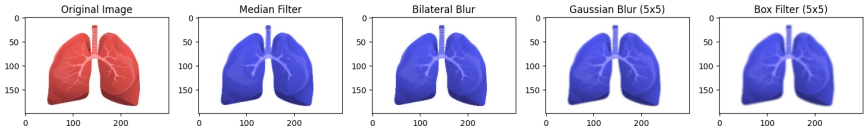



```
# Apply Gaussian blur with different kernel sizes
gaussian_blur_3x3 = cv2.GaussianBlur(resized_image, (3, 3), 0)
gaussian_blur_5x5 = cv2.GaussianBlur(resized_image, (5, 5), 0)
gaussian_blur_7x7 = cv2.GaussianBlur(resized_image, (7, 7), 0)

# Display the Gaussian-blurred images
plt.figure(figsize=(10, 5))
plt.subplot(131), plt.imshow(gaussian_blur_3x3), plt.title('Gaussian Blur (3x3)')
plt.subplot(132), plt.imshow(gaussian_blur_5x5), plt.title('Gaussian Blur (5x5)')
plt.subplot(133), plt.imshow(gaussian_blur_7x7), plt.title('Gaussian Blur (7x7)')
plt.tight_layout()
plt.show()
```


```
# Apply bilateral blur
bilateral_blur = cv2.bilateralFilter(resized_image, 9, 75, 75)

# Display the bilateral-blurred image
plt.imshow(bilateral_blur)
plt.title('Bilateral Blur')
plt.axis('off')
plt.show()
```




```
# Display the original and denoised images side by side
plt.figure(figsize=(15, 5))
plt.subplot(151), plt.imshow(resized_image_rgb), plt.title('Original Image')
plt.subplot(152), plt.imshow(median_filtered), plt.title('Median Filter')
plt.subplot(153), plt.imshow(bilateral_blur), plt.title('Bilateral Blur')
plt.subplot(154), plt.imshow(gaussian_blur_5x5), plt.title('Gaussian Blur (5x5)')
plt.subplot(155), plt.imshow(box_filtered_5x5), plt.title('Box Filter (5x5)')
plt.tight_layout()
plt.show()
```



Question2

```
from google.colab import files

# Upload the image
uploaded = files.upload()
```

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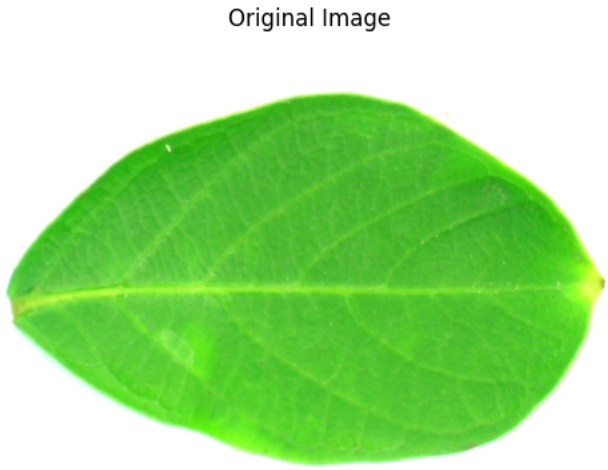
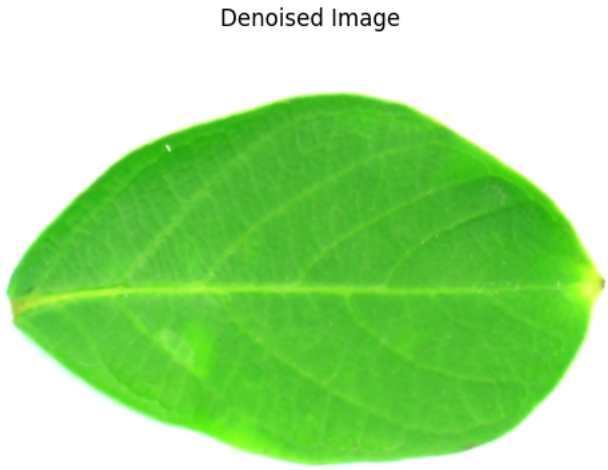
Saving Question 2.jpg to Question 2 (2).jpg

```
import cv2
from matplotlib import pyplot as plt

# Get the filename of the uploaded image
filename = list(uploaded.keys())[0]

# Load the image using OpenCV
image = cv2.imread(filename)
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Display the original image
plt.imshow(image_rgb)
plt.title('Original Image')
plt.axis('off')
plt.show()
```




```
# Apply bilateral filter for denoising
denoised_image = cv2.bilateralFilter(image, 9, 75, 75)

# Display the denoised image
denoised_image_rgb = cv2.cvtColor(denoised_image, cv2.COLOR_BGR2RGB)
plt.imshow(denoised_image_rgb)
plt.title('Denoised Image')
plt.axis('off')
plt.show()
```




```
cv2.imwrite('denoised_image.jpg', cv2.cvtColor(denoised_image, cv2.COLOR_BGR2RGB))
```

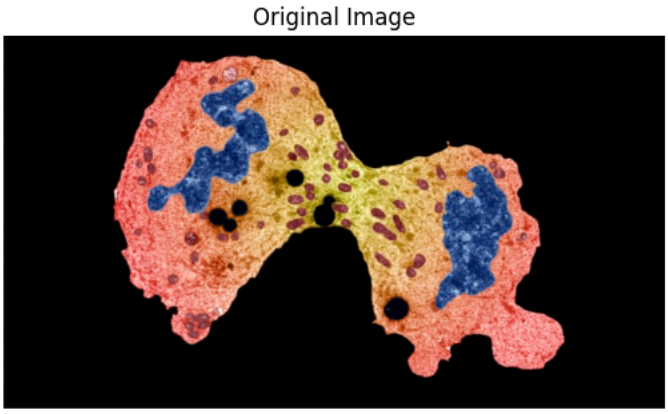
```
True
```

```
Question3
```

```
from google.colab import files

# Upload the image
uploaded = files.upload()
uploaded = files.upload()
```

```
Choose Files No file chosen  Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving Question 3 (1).png to Question 3 (1) (4).png
Choose Files No file chosen  Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
```

```
import cv2
from matplotlib import pyplot as plt

# Get the filename of the uploaded image
filename = list(uploaded.keys())[0]

# Load the image using OpenCV
image = cv2.imread(filename)
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Display the original image
plt.imshow(image_rgb)
plt.title('Original Image')
plt.axis('off')
plt.show()
```




```
# Convert the image to the HSV color space
hsv_image = cv2.cvtColor(image, cv2.COLOR_BGR2HSV)

# Define the lower and upper bounds for segmentation based on color
lower_bound = (0, 0, 0)  # Adjust these values based on the color you want to segment
upper_bound = (255, 255, 255)

# Create a binary mask by thresholding the image
mask = cv2.inRange(hsv_image, lower_bound, upper_bound)

# Apply the mask to the original image
segmented_image = cv2.bitwise_and(image_rgb, image_rgb, mask=mask)

# Display the segmented image
plt.imshow(segmented_image)
plt.title('Segmented Image')
plt.axis('off')
plt.show()
```