# Exercise 4

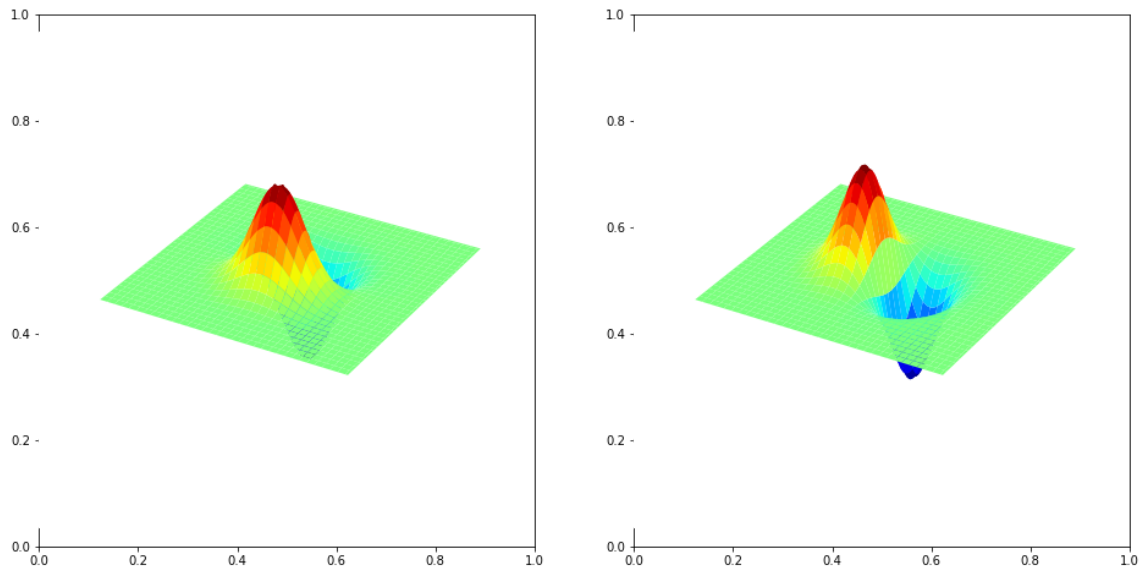
## Name : Ekanayaka S.D.

## Index : 190162F

# Question 1

In [49]:

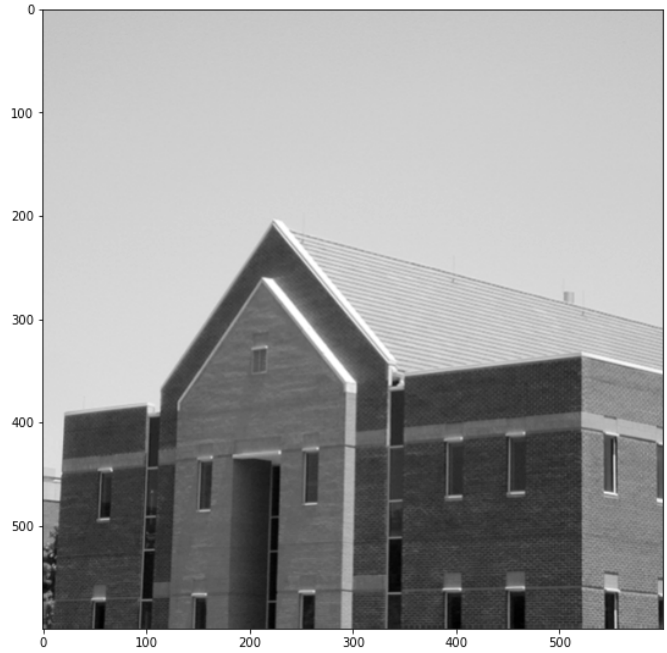
```
import cv2 as cv
import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm


fig,ax =plt.subplots(1,2,figsize = (16,8))
ax1 =fig.add_subplot(121,projection = '3d')
ax2 = fig.add_subplot(122,projection = '3d')
delta =0.1
XX ,YY = np.meshgrid(np.arange(-5,5+delta,delta),np.arange(-5,5+delta,delta))

sigma = 1

g = np.exp(-(XX**2+ YY**2)/(2*sigma**2))

g /=np.sum(g)
sobel_v = np.array([[-1,-2,-1],[0,0,0],[1,2,1]],dtype = np.float32)

g_x = cv.filter2D(g,-1,sobel_v)
sobel_h = np.array([[-1,0,1],[-2,0,2],[-1,0,1]],dtype = np.float32)

g_y = cv.filter2D(g,-1,sobel_h)
surf1 = ax1.plot_surface(XX,YY,g_x,cmap = cm.jet,linewidth=0,antialiased = True)
surf2 = ax2.plot_surface(XX,YY,g_y,cmap = cm.jet,linewidth=0,antialiased = True)

ax1.axis('off')
ax2.axis('off')
plt.show()
```

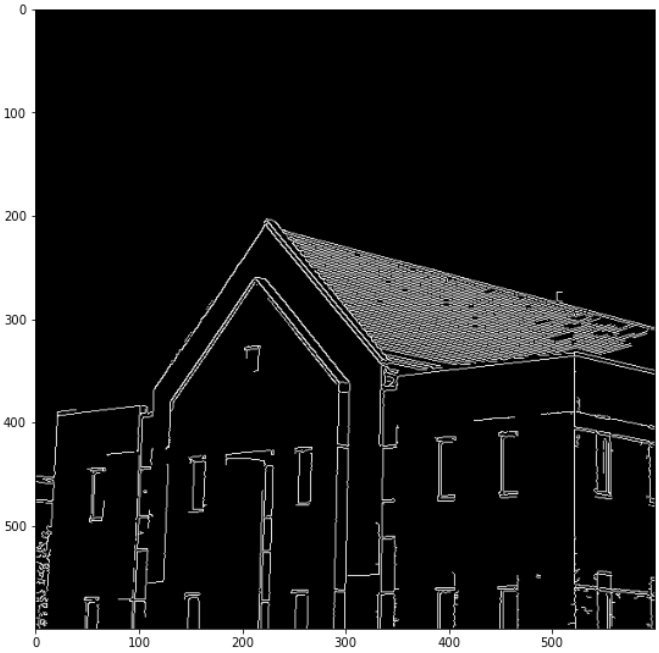



# Question 4

In [50]:

```
import cv2 as cv
import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm


img = cv.imread(r'building.tif',cv.IMREAD_GRAYSCALE)
assert img is not None

edges = cv.Canny(img,100,200)#image low threshold, high threshold

fig,ax = plt.subplots(1,2,figsize=(20,20))

ax[0].imshow(img,cmap = 'gray')
ax[1].imshow(edges,cmap ='gray')
plt.show()
```

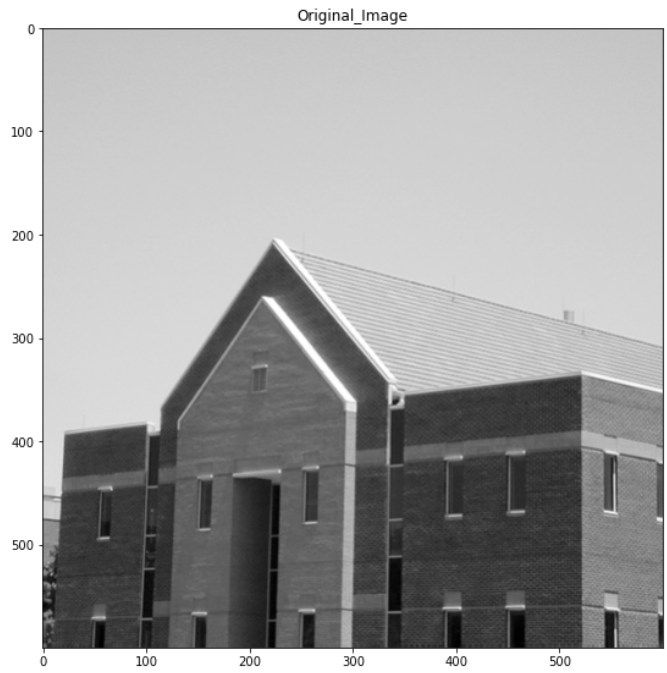


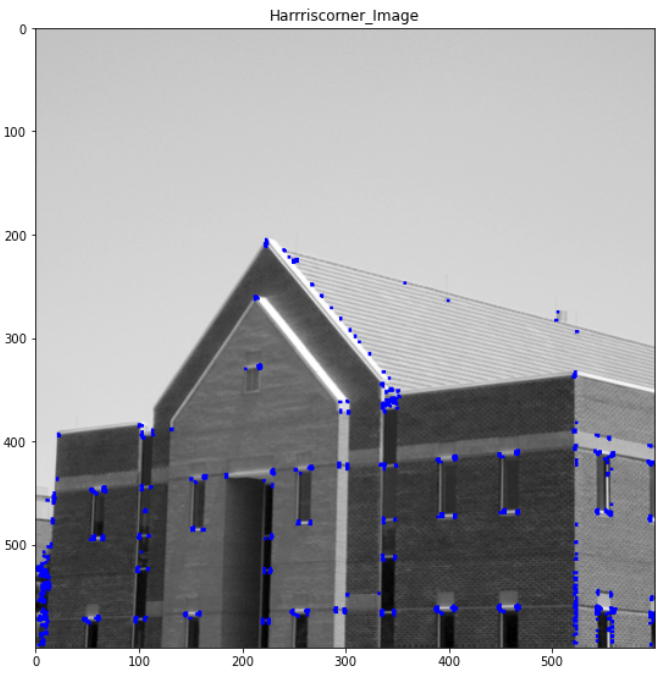


## Question 2

In [51]:

```
import numpy as np
import cv2 as cv
filename = 'building.tif'
img1 = cv.imread(filename)
img = cv.imread(filename)
gray = cv.cvtColor(img,cv.COLOR_BGR2GRAY)
gray = np.float32(gray)
dst = cv.cornerHarris(gray,2,3,0.04)
#result is dilated for marking the corners, not important
dst = cv.dilate(dst,None)
# Threshold for an optimal value, it may vary depending on the image.
img[dst>0.01*dst.max()]=[0,0,255]

fig,ax = plt.subplots(1,2,figsize=(20,20))
ax[0].imshow(img1,cmap = 'gray')
ax[0].set_title("Original_Image")
ax[1].imshow(img,cmap = 'gray')
ax[1].set_title("Harrriscorner_Image")

plt.show()
```



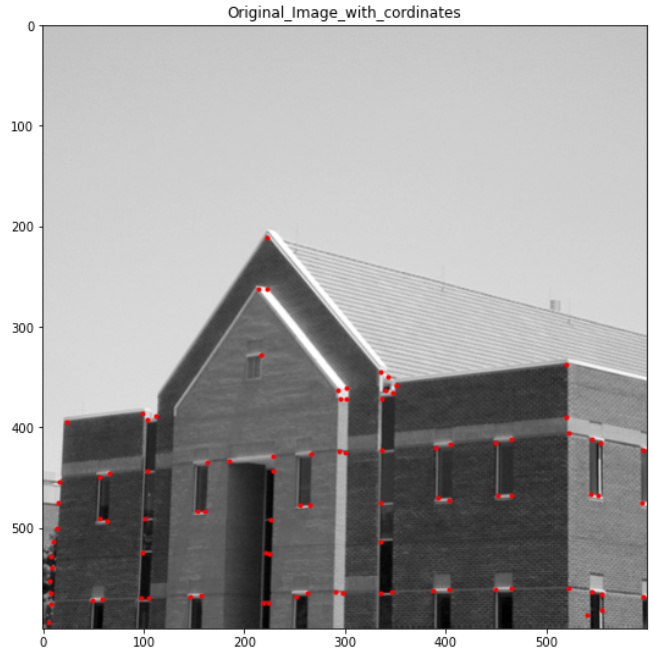



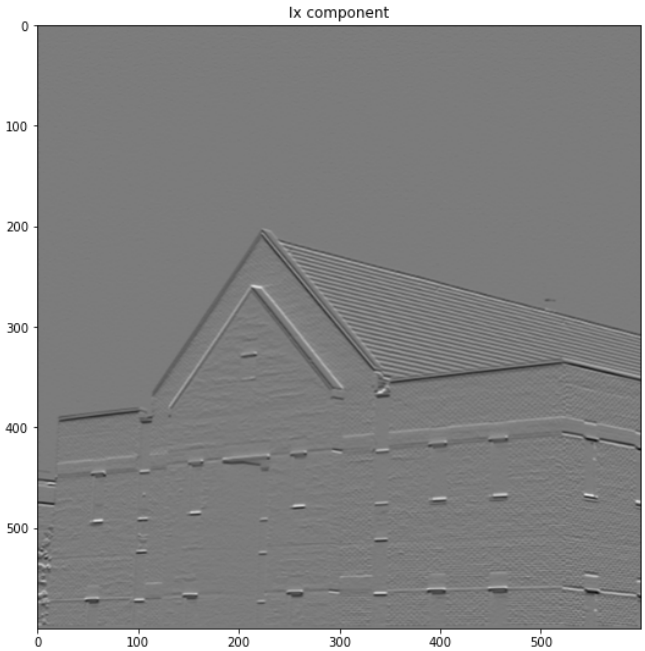

## Question 3

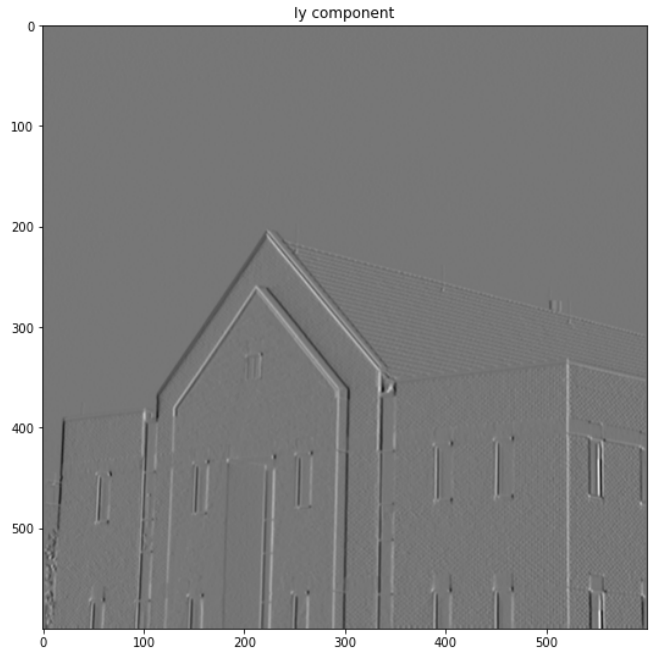
In [52]:

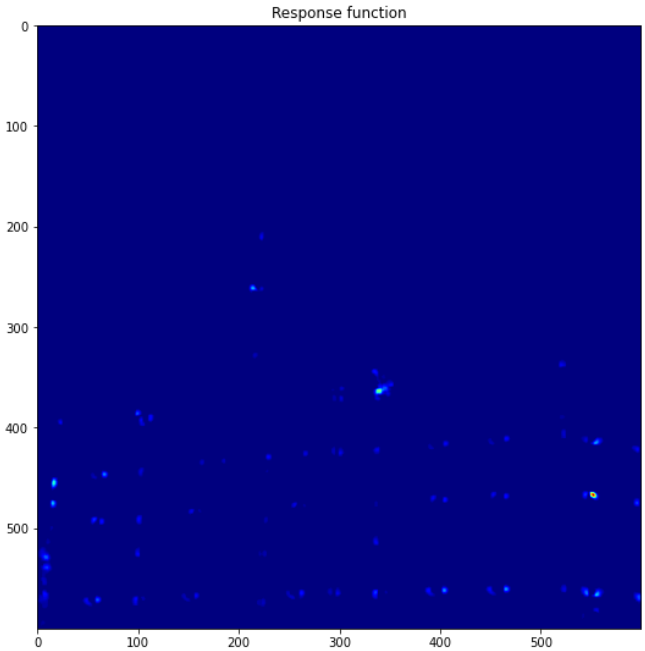
```
import cv2 as cv
import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm
from skimage.feature import peak_local_max


img = cv.imread(r'building.tif',cv.IMREAD_COLOR)
assert img is not None

I =cv.cvtColor(img,cv.COLOR_BGR2GRAY)
I =np.float32(I)
```

```
sobel_v = np.array([[-1,-2,-1],[0,0,0],[1,2,1]],dtype = np.float32)
sobel_h = np.array([[-1,0,1],[-2,0,2],[-1,0,1]],dtype = np.float32)
Ix = cv.filter2D(I,-1,sobel_v)
Iy = cv.filter2D(I,-1,sobel_h)

sigma = 3
ksize = 7

m11=cv.GaussianBlur(Ix*Ix,(ksize,ksize),sigma)
m12=cv.GaussianBlur(Ix*Iy,(ksize,ksize),sigma)

m21=m12

m22=cv.GaussianBlur(Iy*Iy,(ksize,ksize),sigma)

det = m11*m22-m12*m21
trace = m11 + m22
alpha = 0.04

R = det - alpha*trace**2

R[R<1e8] = 0

cordinates = peak_local_max(R,min_distance = 2)

fig,ax=plt.subplots(2,2,figsize=(20,20))
ax[0,0].imshow(img,cmap ='gray')
ax[0,0].set_title("Original_Image_with_cordinates")
ax[0,0].plot(cordinates[:,1],cordinates[:,0],'r.')
ax[0,1].imshow(Ix+127,cmap='gray')
ax[0,1].set_title("Ix component")
ax[1,0].imshow(Iy+127,cmap='gray')
ax[1,0].set_title("Iy component")
ax[1,1].imshow(R+127,cmap=cm.jet)
ax[1,1].set_title("Response function")
plt.show()
```




In [ ]: