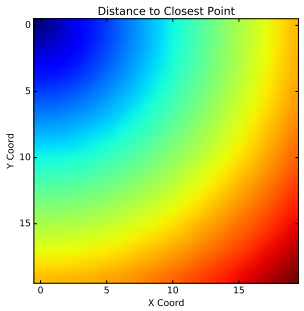
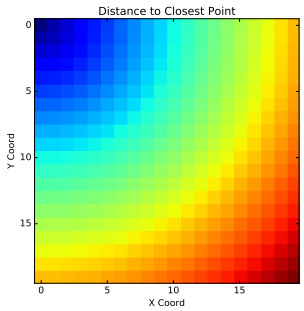
Homework 1

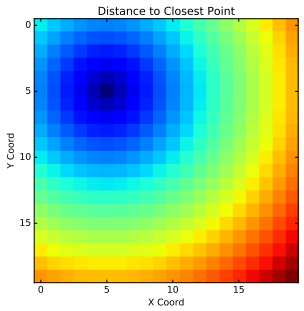
The first six figures are shown below, followed by the final figure on the next page. The last page shows the python code used in this homework assignment.



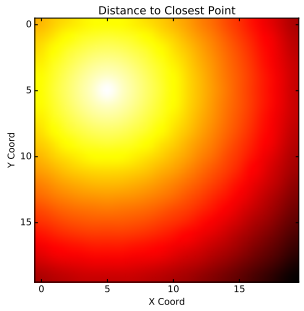
(a) Distance from (0,0)



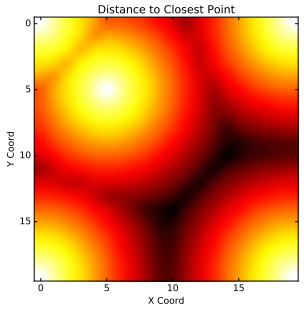
(b) 'Nearest' distance from (0,0)



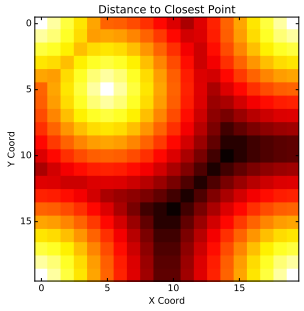
(c) 'Nearest' distance from (5,5)



(d) Distance from (5,5), reversed hot cmap



(e) Distance from (0,0), (5,5), (19,19), (19,0), (0,19), reversed hot cmap



(f) 'Nearest' distance from (0,0), (5,5), (19,19), (19,0), (0,19), reversed hot cmap

Figure 1: Figures a through f

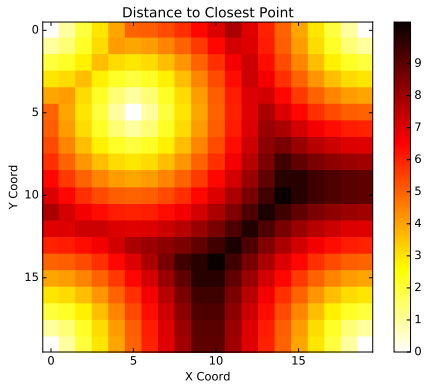


Figure 2: 'Nearest' distance from (0,0), (5,5), (19,19), (19,0), (0,19), reversed hot cmap, scalebar added

Listing 1: Python code

```
import scipy as sp
from scipy.spatial import distance
import matplotlib.pyplot as plt

# Function for creating plots using specified inputs
def plot_dist_grid(length=20,start=[(0,0)],n=1,metric='
    euclidean',interp=None,cmap=None,cbar=False,title='
    Distance to Closest Point',xlabel="X Coord",ylabel="Y
    Coord"):

  # Create array of x and y coordinates
  x_array = sp.zeros((length,length)) + sp.arange(length)
  y_array = sp.zeros((length,length)) + sp.expand_dims(sp.
    arange(length),length)
  coords = zip(x_array.ravel(),y_array.ravel())

  # Iterate over coords to calculate distance from 'start'
  minima = []
  for i in range(len(start)):
    val = distance.cdist([start[i]], coords, metric).reshape(
    length,length)
    if i == 0:
      minima = sp.copy(val) # Assume all are minimums
    else:
      minima = sp.minimum(minima,val) # Take smaller

  # Create plot from 'minima' array
  fig, ax = plt.subplots()
  cax = ax.imshow(minima,interpolation=interp,cmap=cmap)
```

```
25    if cbar:
26      cbar = fig.colorbar(cax, ticks=[range(int(sp.amax(minima))
        )])
27    ax.set_title(title)
28    ax.set_xlabel(xlabel)
29    ax.set_ylabel(ylabel)
30    # fig.savefig('figure' + str(n) + '.pdf')
31    plt.show()
32
33 # Request seven plots for homework assignment (in order)
34 plot_dist_grid()
35 plot_dist_grid(start=[(0,0)],n=2,interp='nearest')
36 plot_dist_grid(start=[(5,5)],n=3,interp='nearest')
37 plot_dist_grid(start=[(5,5)],n=4,interp='spline36',cmap='hot_r
       ')
38 plot_dist_grid(start=sp.array([(0,0),(5,5),(19,19),(19,0)
       ,(0,19)]),n=5,interp='spline36',cmap='hot_r')
39 plot_dist_grid(start=sp.array([(0,0),(5,5),(19,19),(19,0)
       ,(0,19)]),n=6,interp='nearest',cmap='hot_r')
40 plot_dist_grid(start=sp.array([(0,0),(5,5),(19,19),(19,0)
       ,(0,19)]),n=7,cbar=True, interp='nearest',cmap='hot_r')
```