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import sys
import numpy as np
import matplotlib.pyplot as plt

# Function to know if we have a CCW turn
def RightTurn(p1, p2, p3):
  if (p3[1]-p1[1])*(p2[0]-p1[0]) >= (p2[1]-p1[1])*(p3[0]-p1[0]):
    return False
  return True

# Main algorithm:
def GrahamScan(P):
  P.sort()      # Sort the set of points
  P = np.array(P)     # Convert the list to numpy array
  plt.figure()      # Create a new fig
  L_upper = [P[0], P[1]]    # Initialize the upper part
  # Compute the upper part of the hull
  for i in range(2,len(P)):
    L_upper.append(P[i])
    while len(L_upper) > 2 and not RightTurn(L_upper[-1],L_upper[-2],L_upper[-3]):
      del L_upper[-2]
    L = np.array(L_upper)
    plt.clf()   # Clear plt.fig
    plt.plot(L[:,0],L[:,1], 'b-', picker=5) # Plot lines
    plt.plot(P[:,0],P[:,1],".r")    # Plot points
    plt.axis('off')   # No axis
    plt.show(block=False) # Close plot
    plt.pause(0.0000001)  # Mini-pause before closing plot
  L_lower = [P[-1], P[-2]]  # Initialize the lower part
  # Compute the lower part of the hull
  for i in range(len(P)-3,-1,-1):
    L_lower.append(P[i])
    while len(L_lower) > 2 and not RightTurn(L_lower[-1],L_lower[-2],L_lower[-3]):
      del L_lower[-2]
    L = np.array(L_upper + L_lower)
    plt.clf()               # Clear plt.fig
    plt.plot(L[:,0],L[:,1], 'b-', picker=5)   # Plot lines
    plt.plot(P[:,0],P[:,1],".r")              # Plot points
    plt.axis('off')         # No axis
    plt.show(block=False)   # Close plot
    plt.pause(0.0000001)  # Mini-pause befor closing plot
  del L_lower[0]
  del L_lower[-1]
  L = L_upper + L_lower     # Build the full hull
  plt.axis('off')
  plt.show()
  return np.array(L)

def main():
  try:
    N = int(sys.argv[1])
  except:
    N = int(input("Introduce N: "))

  # By default we build a random set of N points with coordinates in [-300,300)x[-300,300):
  P = [(np.random.randint(-300,300),np.random.randint(-300,300)) for i in range(N)]
  L = GrahamScan(P)
  P = np.array(P)

  # Plot the computed Convex Hull:
  plt.figure()
  plt.plot(L[:,0],L[:,1], 'b-', picker=5)
  plt.plot([L[-1,0],L[0,0]],[L[-1,1],L[0,1]], 'b-', picker=5)
  plt.plot(P[:,0],P[:,1],".r")
  plt.axis('off')
  plt.show()

if __name__ == '__main__':
  main()

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Introduce N: 10
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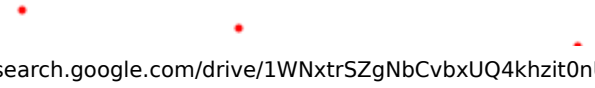

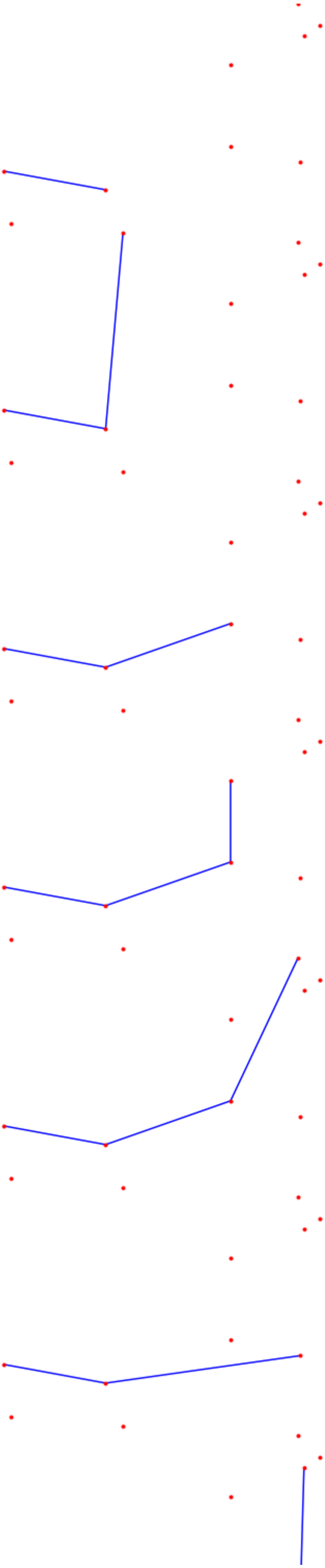

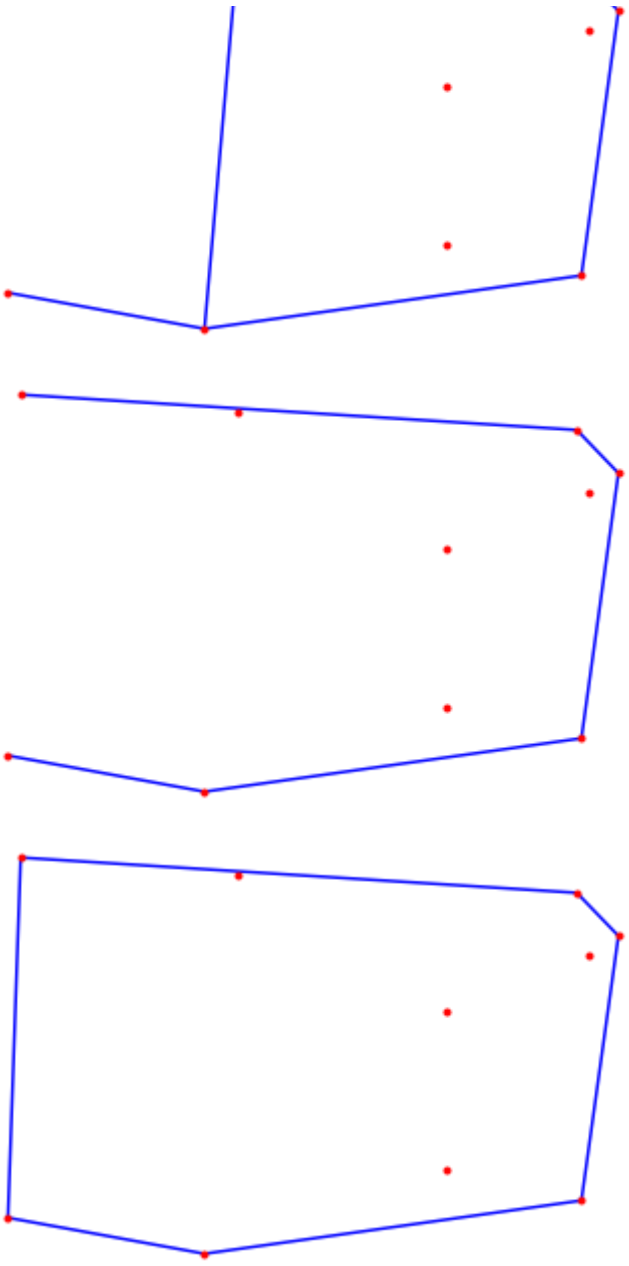

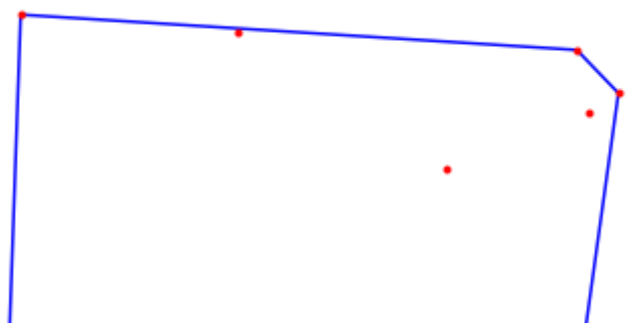

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