Faculty of Engineering and Applied Science

SOFE 3770U Design & Analysis of Algorithms

Assignment 2 Report

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Pseudo Code:

Import matplotlip.pyplot as plt			
Import random as r			
Def plot_pareto_frontier(Xs, Ys, maxX=True, maxY=True):			
	Sorted_list = sorted([[Xs[i], Ys[i]], for i in range(len(Xs))], reverse = maxX)	c1	1
	Pareto_front = [sorted_list[0]]	c2	1
	For pair in sorted_list[:]:	c3	n
		if maxY:	c4	n-1
			if pair[1] >= pareto_front[-1][1]:	c5	T((n)/2)
				pareto_front.append(pair)	c6	T((n)/4)
		else:	c7	T((n-1)/2)
			If pair[1] <= pareto_front[-1][1]:	c8	T((n-1)/2)
				pareto_front.append(pair)	c9	T((n-1)/4)
	plt.scatter(Xs, Ys)	c10	1
	pf_X = [pair[0] for pair in pareto_front]	c11	1
	pf_Y = [pair[1] for pair in pareto_front]	c12	1
	print("Pareto Frontier [MaxX: %s, MaxY: %s]: " % (maxX, maxY))	c13	1
	print(pareto_front)	c14	1
	plt. plot(pf_X, pf_Y)	c15	1
	plt. xlabel("Objective 1")	c16	1
	plt. ylabel("Objective 2")	c17	1
	plt. show()	c18	1
Def generate_points(n):			
	Xs = []	c1	1
	Ys = []	c2	1

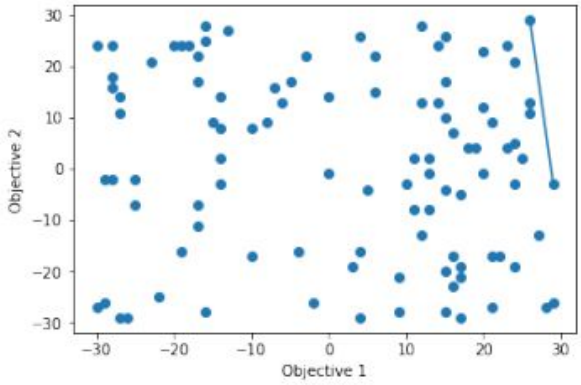
	For _ in range(n):	c3	n
	xs. append(r. randrange(-30, 30))	c4	n-1
	ys. append(r. randrange(-30, 30))	c5	n-1
	return (xs, ys)	c6	1
points = generate_points(100)		c1	1
plot_pareto_frontier(points[0], points[1], maxX=True, maxY=True)		c2	1
plot_pareto_frontier(points[0], points[1], maxX=False, maxY=True)		c3	1
plot_pareto_frontier(points[0], points[1], maxX=True, maxY=False)		c4	1
plot_pareto_frontier(points[0], points[1], maxX=False, maxY=False)		c5	1

Time complexity:

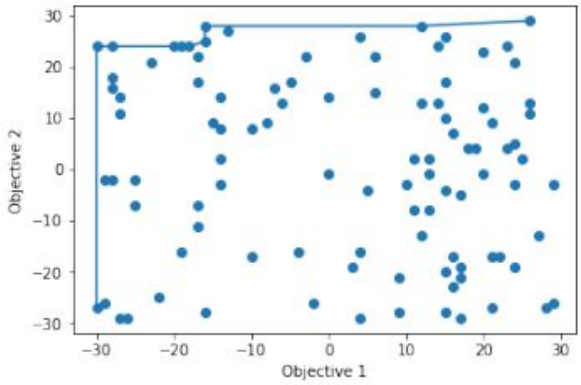
The time complexity of the pareto frontier is $O(n^2)$. Time complexity of $O(n^2)$ is due to the comparison from pair to pair.

Example:

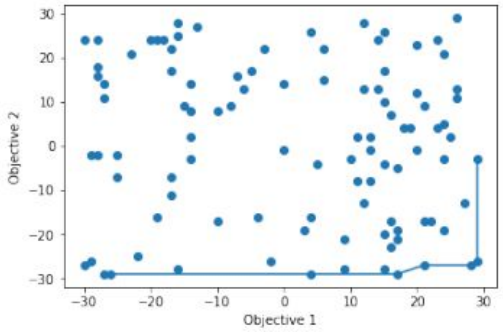
```
Pareto Frontier [MaxX: True, MaxY: True]:
[[29, -3], [26, 29]]
```




```
Pareto Frontier [MaxX: False, MaxY: True]:
[[-30, -27], [-30, 24], [-28, 24], [-20, 24], [-19, 24], [-18, 24],
[-16, 25], [-16, 28], [12, 28], [26, 29]]
```




```
Pareto Frontier [MaxX: True, MaxY: False]:
[[29, -3], [29, -26], [28, -27], [21, -27], [17, -29], [4, -29], [-2
6, -29], [-27, -29]]
```




```
Pareto Frontier [MaxX: False, MaxY: False]:
[[-30, -27], [-27, -29], [-26, -29], [4, -29], [17, -29]]
```