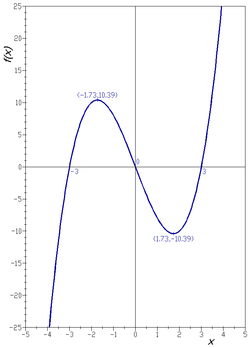
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **p=30**  **z=0.03** | Run1 | | | Run2 | | |
| #sol searched | Best sol | f(sol) | #sol searched | Best sol | f(sol) |
| (2.9, (0.4, -0.5) | 1260 | (-0.60138, 0.40067) | 30.00456 | 1260 | (-0.5984, -0.402) | 30.00319 |
| (-2.5( (-0.5, 0.3) | 840 | (-0.59902, -0.40466) | 30.02368 | 840 | (-0.59712, -0.39892) | 30.0171 |
| ((4.2 (1, -2) | 2100 | (-0.59735, -0.40355) | 30.00993 | 2100 | (-0.60214, -0.39984) | 30.00505 |
| (0,0) ( (0,0) | 810 | (-0.6019, -0.39934) | 30.00285 | 810 | (-0.59619, -0.40309) | 30.01068 |

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| --- | --- | --- | --- | --- | --- | --- |
| **p=120**  **z=0.03** | Run1 | | | Run2 | | |
| #sol searched | Best sol | f(sol) | #sol searched | Best sol | f(sol) |
| (2.9, (0.4, -0.5) | 4560 | (-0.60182, -0.39875) | 30.0023 | 4440 | (-0.59995, -0.40007) | 30.0 |
| (-2.5( (-0.5, 0.3) | 3240 | (-0.59819, -0.4019) | 30.0031 | 3120 | (-0.60414, -0.39825) | 30.01275 |
| ((4.2 (1, -2) | 7560 | (-0.59974, -0.40126) | 30.00173 | 7320 | (-0.59999, -0.39985) | 30.00004 |
| (0,0) ( (0,0) | 2880 | (-0.59987, -0.40006) | 30.00001 | 2760 | (-0.60175, -0.39808) | 30.00309 |

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| --- | --- | --- | --- | --- | --- | --- |
| **p=30**  **z=0.1** | Run1 | | | Run2 | | |
| #sol searched | Best sol | f(sol) | #sol searched | Best sol | f(sol) |
| (2.9, (0.4, -0.5) | 390 | (-0.6062, -0.39096) | 30.06462 | 420 | (-0.59626, -0.40333) | 30.01098 |
| (-2.5( (-0.5, 0.3) | 300 | (-0.58703, -0.41125) | 30.12846 | 270 | (-0.59692, -0.39524) | 30.06852 |
| ((4.2 (1, -2) | 750 | (-0.59061, -0.41506) | 30.16727 | 720 | (-0.60209, -0.39535) | 30.01879 |
| (0,0) ( (0,0) | 300 | (-0.59466, -0.41736) | 30.29717 | 270 | (-0.61312, -0.40015) | 30.2158 |

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| --- | --- | --- | --- | --- | --- | --- |
| **p=120**  **z=0.1** | Run1 | | | Run2 | | |
| #sol searched | Best sol | f(sol) | #sol searched | Best sol | f(sol) |
| (2.9, (0.4, -0.5) | 1680 | (-0.59223, -0.40697) | 30.04767 | 1560 | (-0.60554, -0.40106) | 30.0494 |
| (-2.5( (-0.5, 0.3) | 1200 | (-0.59576, -0.40133) | 30.01462 | 1080 | (-0.59435, -0.40895) | 30.03625 |
| ((4.2 (1, -2) | 2760 | (-0.60597, -0.39269) | 30.04306 | 2400 | (-0.59256, -0.40854) | 30.05929 |
| (0,0) ( (0,0) | 1080 | (-0.59787, -0.39706) | 30.02846 | 1080 | (-0.60109, -0.40184) | 30.00968 |

I believe P and Z rather predictable effects on the number of solutions searched compared to changes in SP. P determines how many new solutions will be compared to the current one in order to determine if the search should continue or give up. Because of this it was easy to predicted that if you keep all other vars the same and only increase P that it would always result in a higher number of solutions checked, and tests confirmed this. Next Z is slightly trickier in my opinion, the more I thought about it the more pros and cons I found for both increasing and decreasing its value. Z determines how wide a range each of the P solutions value will be. Thus if the global max is far away from your current solution with many local maxima and minima in between, then the global maxima is only reachable with a higher (enough) value of Z. That’s because (I’m theorizing) Z is basically determining how relatively good your solutions are. Or another words, a higher z will help find a ‘good’ solution relative to the values in Zs range (this is also assuming that P is not changing so it doesn’t get high enough to paint a clear picture of every solution in Zs range as it increases). Ok so let’s stop being abstract about it, lets picture a graph (like this one )  say we are starting at the far right of the graph at (4, 25) and we are searching for the best Y axis value, with lower being better. With a low-Z value (lets say 0.1) we will go all the down the slope (right to left) constantly but slowly cause we can only compare with values close to the start. So high-Z means we will get the lowest local value but at the cost of many searches to get there and then being trapped there. A high-Z (lets be extreme and say 7) means that it could get close to the local minima on the first search! And from there it could get on the other side of the hill at say (-3.5, -9), this is not as low as the local min of -10.3 that the low-Z found, but it can be found after a couple searches at most when low-Z could take hundreds; that’s good! However, now that high-Z made it to the other side of the hill (on the left now) it has the ability to go all the way down to -25, but because all of its P searches are spread out so far out (again assuming that P is not high enough to cover most values in Zs range), all of the P solutions found will likely have a higher value than -7 and thus the search will stop there. At this point high-Z would most likely make it all the way down to -25. But again that’s only if we started on that side of the hill. This brings back to when I said something about Z gives the best solution relative to Z. We have P = 5: with low-Z at (1.7, -10.3) we will get the best solution relative to all the values in its range from x = 1.6 to 1.8, which is -10.3ish. With high-Z at (-3.5, -9) the range is all values from x = -4 to 3.5, and most of the y values are much higher than -9 thus -9 is a good solution relative to the range of Z and so the search stops, even y could be better. This also intuitively means that the number of comparisons are higher for a lower Z.

SP just determines where you start, so it is unpredictable how many solutions will be checked if the other variables are constant. Starting with an initially ‘relatively’ good solution will always result in fewer comparisons because… well obviously there fewer values that could be better.

33rd search

From looking at the 32 keeping in mind everything I state above, I noticed that all of the tests found a minima near (-.6, -.3). I concluded that it was either due to it being a global minima, or that the search was getting stuck in a minima due to 1. Where it started and 2. Having a Z to small to escape it. So because all of the solutions had negative x and y values, I decided to do my search start with both positive numbers. I set SP = [1, 1] and I increased my Z to 1 in order to get near the best solution relative to values (0, 0) to (2, 2). I also increased my P to 500 to limit the number of comparisons even though I prioritized a better solution over efficiency. The results were finding a solution of -502801 at (0.84279, 0.95308) with still only 1500 comparisons! I never would’ve guessed that there was a solution with such a low value but I have a feeling that was part of the reason for this assignment.