

### Question 3

a)

For f1:

Step size	Mean (steps)	Standard deviation(steps)	Mean (final value)	Standard deviation (final value)
0.01	286.13	165.996	1.776	0.332
0.05	56.58	30.365	1.677	0.359
0.1	28.65	15.755	1.714	0.350
0.2	16.31	7.991	1.721	0.349

For f2:

Step size	Mean (steps)	Standard deviation(steps)	Mean (final value)	Standard deviation (final value)
0.01	577.84	247.644	9.1	2.142
0.05	117.16	48.115	8.8	2.400
0.1	60.41	23.647	8.98	2.254
0.2	30.73	10.779	8.86	2.354

From the data above, we can see that when step size decreases, mean and standard deviation value for steps increases. The trend of mean and standard deviation for final value is not that clear, to improve this situation, more data should be recorded for each step size to get the general trend solution.

b) step size = 0.01

For f1:

Beam width	Mean (steps)	Standard deviation(steps)	Mean (final value)	Standard deviation (final value)
2	194.01	117.685	1.708	0.351
4	131.34	73.914	1.651	0.358
8	81.68	47.726	1.733	0.343
16	59.25	33.446	1.613	0.354

For f2:

Beam width	Mean (steps)	Standard deviation(steps)	Mean (final value)	Standard deviation (final value)
2	454.47	211.017	8.56	2.562
4	353.56	187.290	8.08	2.799
8	233.24	125.683	7.66	2.926
16	165.77	98.389	7.6	2.939

From the data above, we can see that when beam width decreases, mean and standard deviation of steps increases. Mean and standard deviation values for final value is a little bit different. For f1, we need more data to conclude the general trend. For f2 however, when beam width increases, mean value decreases and standard deviation increases. Also, we can see that both f1 and f2 need fewer steps to achieve the goal state compared to the ones in the former question, which means that local beam search actually improve the hill climbing performance.