COMP 5560 Fall 2022 Assignment 1a

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1. Plots of the Best Run

In this assignment, a random search algorithm is implemented with 5000 evaluations and 30 runs. For each run, the highest fitness encountered is recorded. For the run that produced the highest fitness, the bridge plot (Figure 1) and stair-step plot (Figure 2) of evaluations v. fitness are recorded. Overall, the highest fitness recorded was 34,000,000.
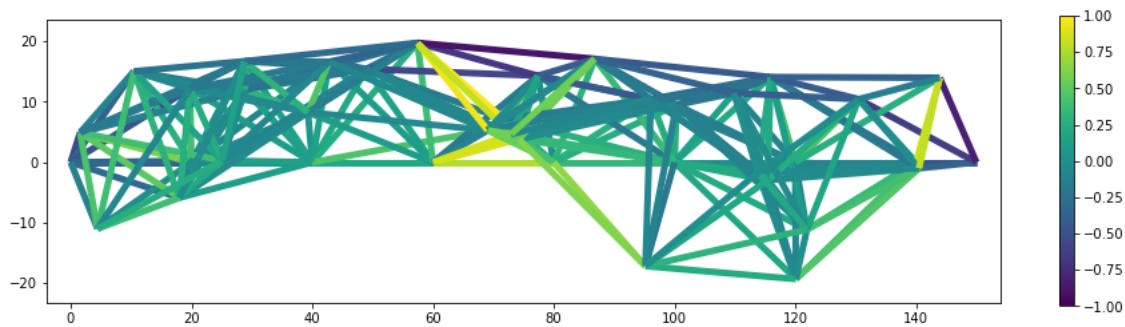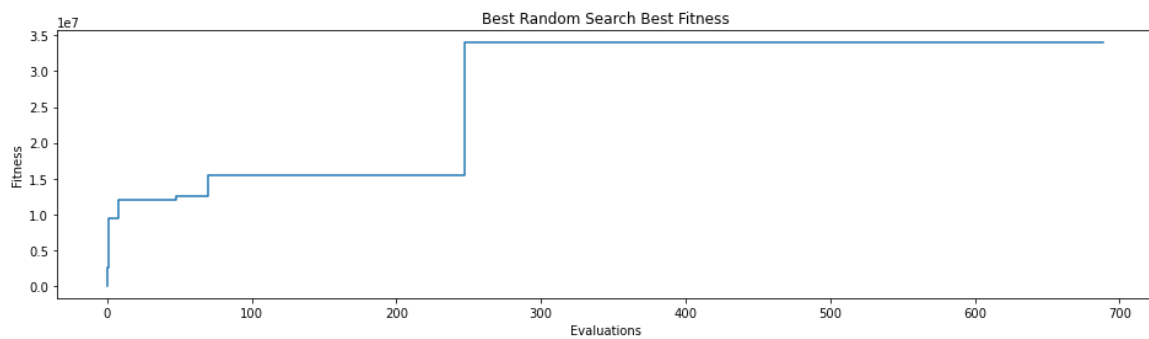

Figure 1: Bridge Plot of the Best Run

Figure 2: Stair-step Plot of the Best Run

2. Analysis using F-Test and t-Test

A two-sample F-Test for equality of variances is used to determine if the variances of the mystery algorithm (data/mysteryAlgorithmResults.txt) and the random search algorithm (data/randomAlgorithmResults.txt) are equal. Given that $F < 1$ and $F < F$ *Critical one-tail*, the null hypothesis of equal variances is rejected and it is determined that the two populations have significantly unequal variances. This prompts the use of a two-sample t-Test assuming unequal variances.

F-Test Two-Sample for Variances	random	mystery
Mean	24500000	47083333.33
Variance	1.5931E+13	8.8467E+13
Observations	30	30
df	29	29
α	**0.025**	
F	0.180078931	
P(F<=f) one-tail	7.22455E-06	
F Critical one-tail	0.475964774	

Table 1: F-Test of Random Search and Mystery Algorithms

A two-sample t-Test is used to determine if the means of the mystery algorithm (data/mysteryAlgorithmResults.txt) and the random search algorithm (data/randomAlgorithmResults.txt) are equal. Given that *t Stat* < 0 and *t Stat* $< -t$ *Critical two-tail*, the null hypothesis of equal means is rejected and it is determined that the two populations have significantly unequal means. The mystery algorithm can be assumed to produce a significantly higher mean fitness than the random search algorithm.

t-Test: Two-Sample Assuming Unequal Variances	random	mystery
Mean	24500000	47083333.33
Variance	1.5931E+13	8.8467E+13
Observations	30	30
Hypothesized Mean Difference	0	
df	39	
α	**0.05**	
t Stat	-12.106054	
P(T<=t) one-tail	4.38052E-15	
t Critical one-tail	1.684875122	
P(T<=t) two-tail	8.76103E-15	
t Critical two-tail	2.02269092	

Table 2: t-Test of Random Search and Mystery Algorithms