Homework 7 Advanced Analytics and Metaheuristics

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1. Simulated Annealing

Initial Temperature Looking at our original knapsack problem, we see that the best increase we could expect in the value is 1000. We test with that value as our initial temperature extensively.

Cooling We use both an exponential and Cauchy cooling scheme.

Probabilities Add code here

Stopping Criteria We first attempted to just run through a total number of iterations with a for loop, just allowing it to continue until it exhausted all possibilities in the for loop. This had a few draw backs: while simple, it could get stuck and take a long time. It could also hit a piece of the logic and not find an acceptable new solution. I quickly made an edit to the annealing code, if it could not find a suitable neighbor in 100 tries, I exited the loop. It would then return to that loop and again attempt to find a suitable neighbor. Since there are probabilities involved, perhaps it would not find a neighbor to move to.

```
    if evaluate(s)[0] > f_curr[0]:#compare to current not best
        improvements.append(s[:])                 #add to list
        improvements.append(evaluate(s)[:])       #and store its evaluation

if len(improvements)>0:
  w = []
  for i in range(int(len(improvements)/2)):
    w.append(improvements[2*i +1][0])
    whichone = myPRNG.choices(range(int(len(improvements)/2)), weights = w, k
    x_best = improvements[2*whichone]
    f_best = improvements[2*whichone +1]
```

Method								
SA	t_0	Cooling, t_k	M_k	# of temps	Iterations	Items	Weight	Value
	100	$0.99t_{k-1}$	50	1000	126710	39	2487.2	23405
	1000	$0.99t_{k-1}$	50	1000	236504	43	2471	24456.6
	1500	$0.99t_{k-1}$	25	500	625724	44	2499.8	24898.2
	2500	$0.99t_{k-1}$	50	1000	249256	43	2481.0	24747.5