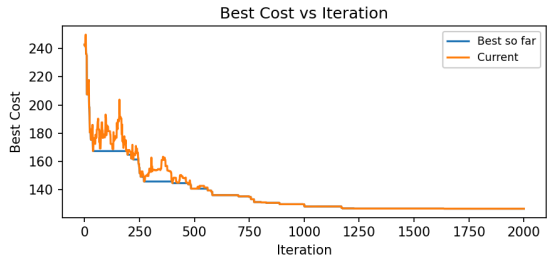
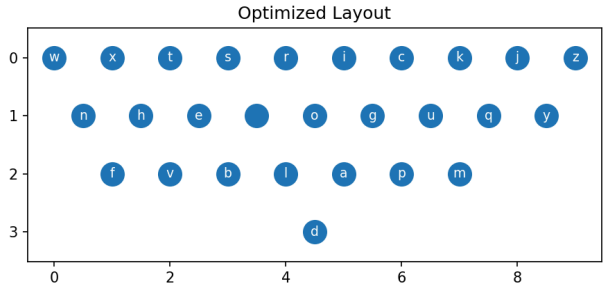
1.The images of loss function over time (t0=5,i=2000,×=0.995,text=quickbrownfox...)and final keyboard layout is attached below





2.

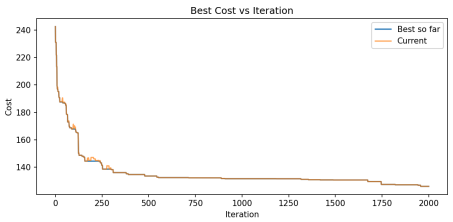
Temperature effect:

- The effect is affected on the probability function exp(-delta/Temp) allowing solution to escape from local minima and explore more solutions
- High T0: easy to escape local minima and explore more thus takes more time
- Low T0: fewer soln accepted than best cost and not explored much thus less time taken

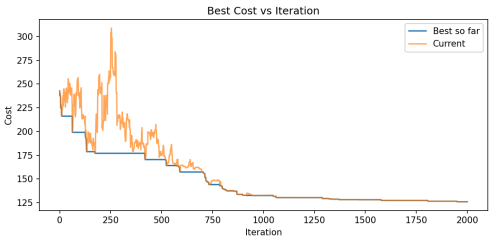
Temp + iterations :

- High T0 + more iter : Very thorough exploration, high runtime, best chance at near-optimal layouts.
- Low T0+ low iter : Fast convergence, but likely stuck in a bad layout

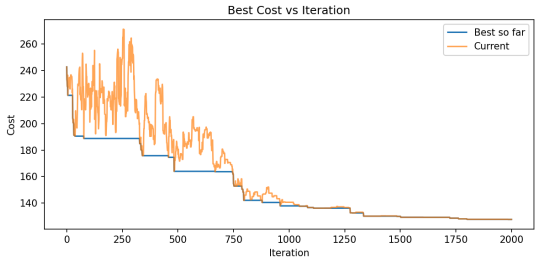
VARIABLE: TEMP , CONST: ALPHA , ITERS = 0.995 , 2000



t0= 2.0



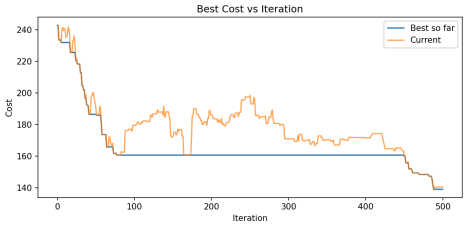
t0=50.0

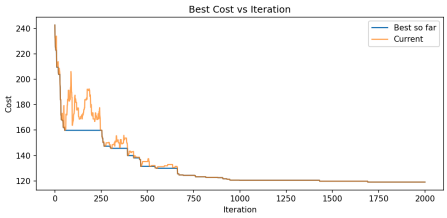


t0=10.0

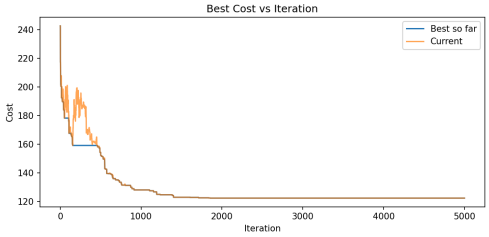
Low temperature leads to early convergence and may get stuck in local minima, while high temperature introduces more fluctuations but eventually achieves a lower best cost.

VARIABLE: ITERS , CONST: ALPHA , TEMP = 0.995 , 5.0





ITERS =500 ITERS=2000



ITERS= 5000

increasing the number of iterations improves the final best cost. Low iterations may converge prematurely, while higher iterations allow more swaps and better optimization

3.

```
print(f"Baseline (QWERTY assignment) cost: {baseline_cost:.4f}"

# Annealing - give parameter values
params = SAParams(iters=2000, t0=5.0, alpha=0.955)
start = time.time()
```

The code can be run with iters , t0 , alpha and epoch can be initialized with SAParams