LLM Transcript

2. Modular Code Structure

- **Me:** “Can you refactor my code into separate py files?”
- **Chatgpt:** Produced models.py, data.py, main.py. Snippet from models.py:

```
from dataclasses import dataclass
@dataclass
class Activity:
    code: str
    expected_enroll: int
    preferred: List[str]
    other: List[str]
```

3. Fitness Function & Tests

- **Me:** “Create fitness functions relative to my code”
- **Chatgpt:** Created fitness.py. Example scorer in fitness.py:

```
def score_room_size(assignment: Assignment) -> float:
    cap, exp = assignment.room.capacity, assignment.activity.expected_enroll
    if cap < exp: return -0.5
    return 0.3  # simplified snippet
```

4. Smoke Test Harness

- **Me:** “What is the best way to utilize the pytest library?”
- **Chatgpt:** Explained import pytest and built smoke_test.py. Snippet:

```
def smoke_test(num_schedules=1000):
    scores = [schedule_fitness(random_schedule()) for _ in range(num_schedules)]
    print(f"Average fitness: {statistics.mean(scores):.2f}")
```

5. Improved Smoke Test

- **Me:** “Can you refactor the parts of my code to print the best and worst schedules?”
- **Chatgpt:** Enhanced to print best/worst schedules:

```
worst = min(scored, key=lambda x: x[0])
print("Worst schedule:", worst)
```

6. GA Loop

- **Me:** “Can you implement my GA into a loop with my given functions”
- **Chatgpt:** Drafted ga.py with selection, crossover, mutation. Snippet:

```
def select_parents(pop, fits):
   exps = [math.exp(f) for f in fits]
   return random.choices(pop, weights=[e/sum(exps) for e in exps], k=2)
```

7. Parameter Check

- **Me:** “Are these values in accordance with the original parameters?”
- **Chatgpt:** Verified N=500, λ=0.01, ≥100 gens, <1% stopping—all match spec.

8. Schedule Representation Bug & Fix

- **Me:** “Fix duplicates so each activity appears once.”
- **Chatgpt:** Updated random_schedule:

```
def random_schedule():
   return [Assignment(act, random.choice(rooms), ...)
         for act in activities]
```

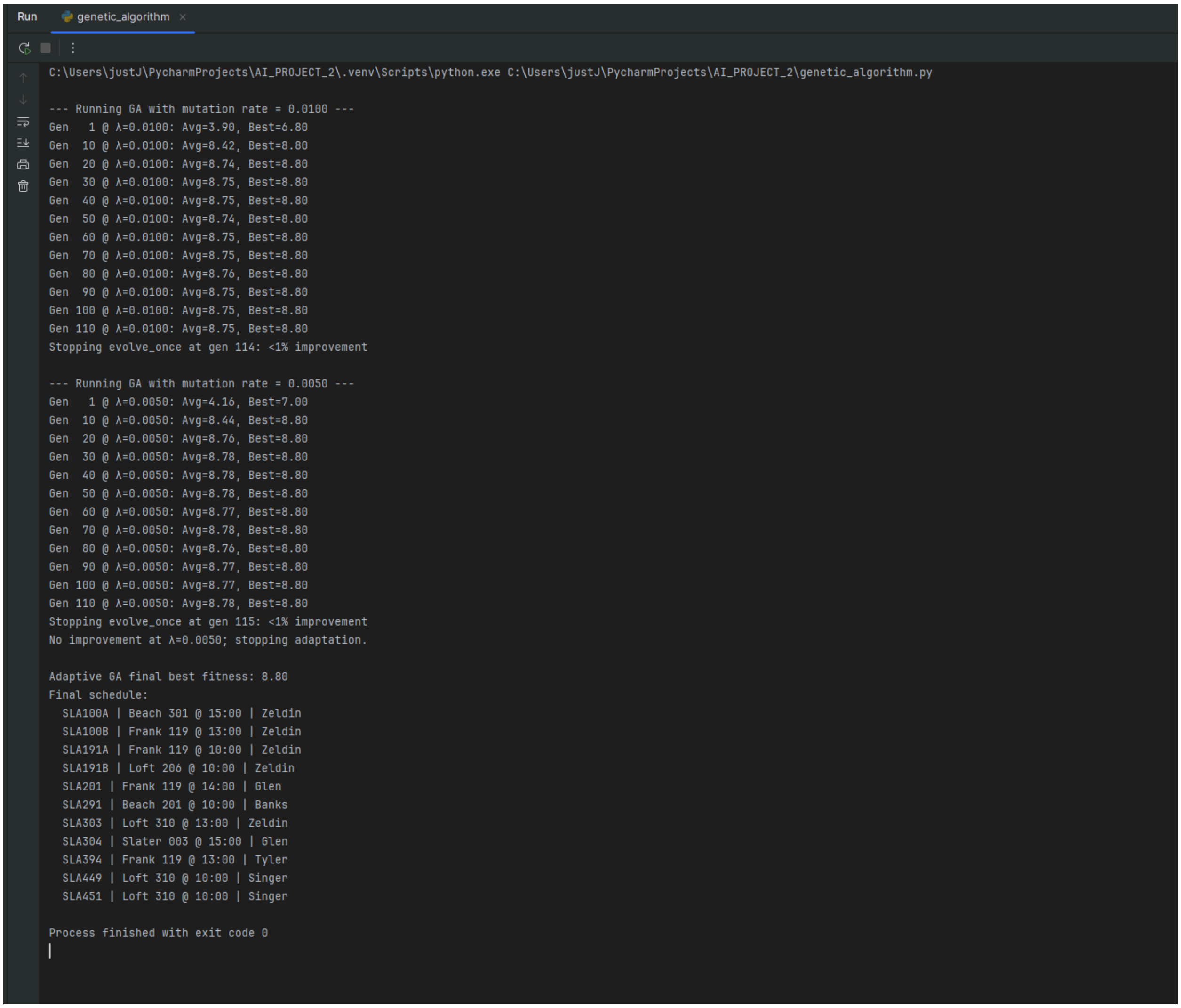
9. Adaptive Mutation Rate

- **Me:** “With my given code, implement adaptive halving.”
- **Chatgpt:** Added evolve_once and adaptive_evolve:

```
def adaptive_evolve():
   rate = INITIAL_MUTATION_RATE
   while improved:
      _, fit, _ = evolve_once(rate)
      rate /= 2
```

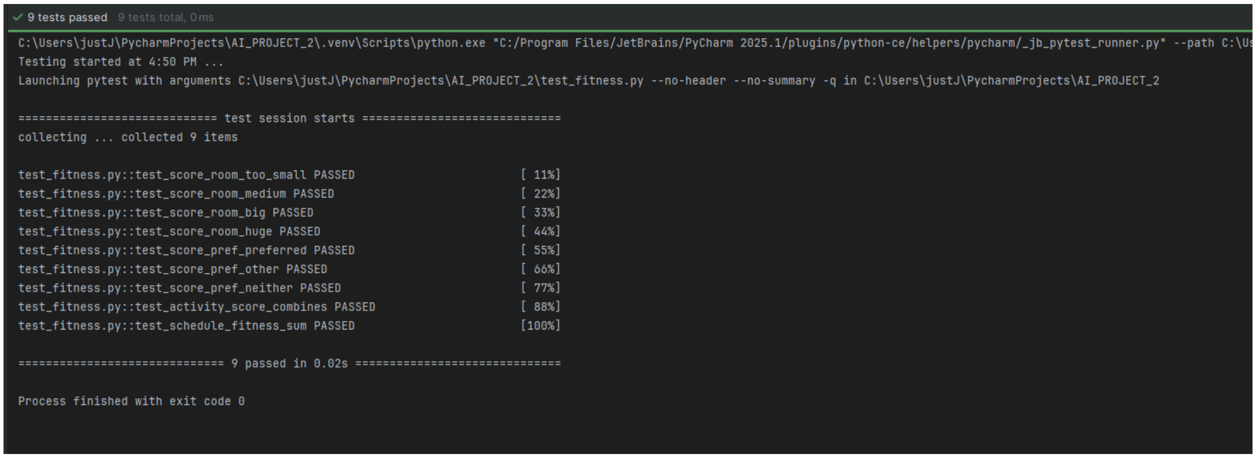
Screen Captures

Running Main:



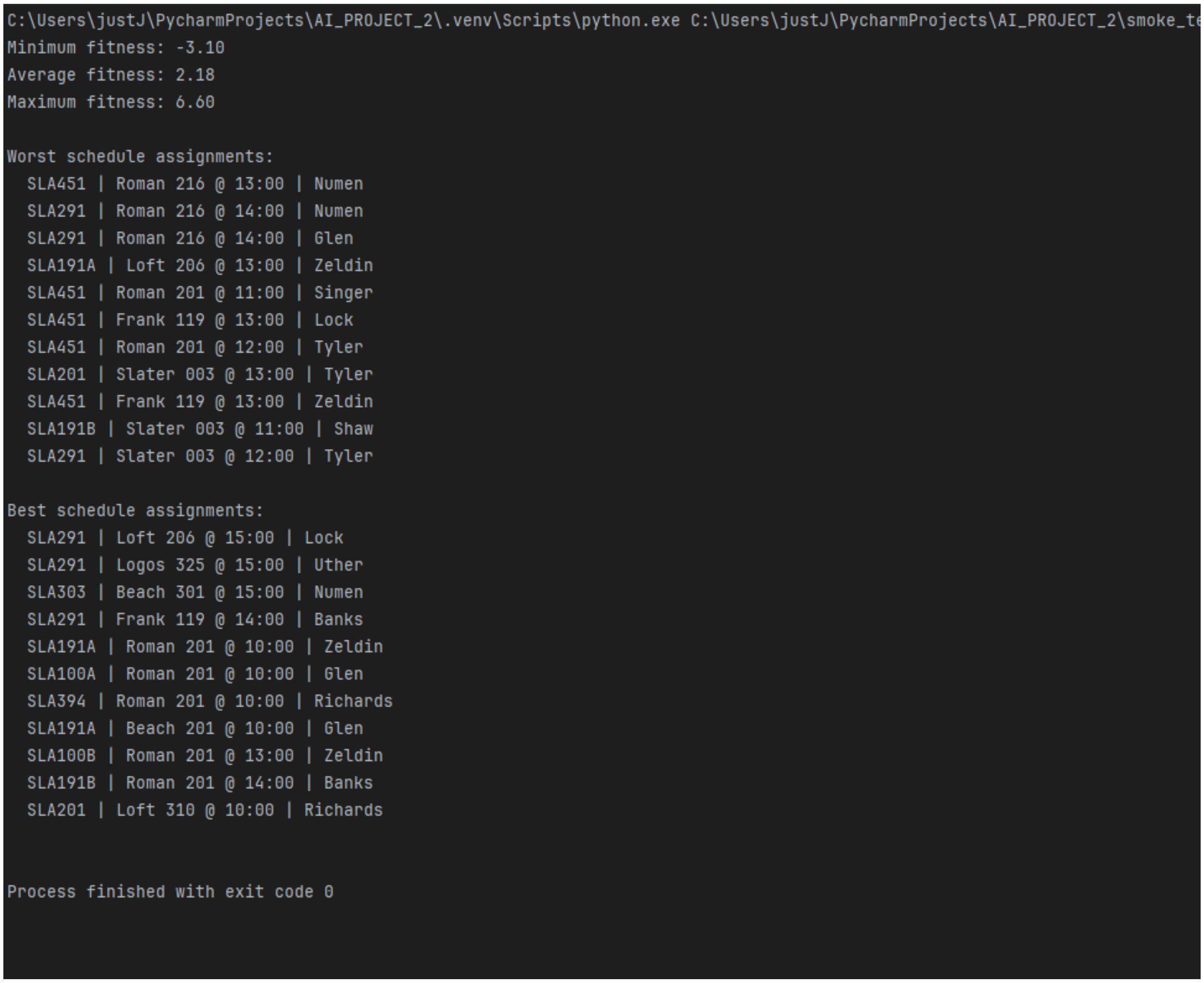
```
C:\Users\justJ\PycharmProjects\AI_PROJECT_2\.venv\Scripts\python.exe C:\Users\justJ\PycharmProjects\AI_PROJECT_2\genetic_algorithm.py

--- Running GA with mutation rate = 0.0100 ---
Gen   1 @ λ=0.0100: Avg=3.90, Best=6.80
Gen  10 @ λ=0.0100: Avg=8.42, Best=8.80
Gen  20 @ λ=0.0100: Avg=8.74, Best=8.80
Gen  30 @ λ=0.0100: Avg=8.75, Best=8.80
Gen  40 @ λ=0.0100: Avg=8.75, Best=8.80
Gen  50 @ λ=0.0100: Avg=8.74, Best=8.80
Gen  60 @ λ=0.0100: Avg=8.75, Best=8.80
Gen  70 @ λ=0.0100: Avg=8.75, Best=8.80
Gen  80 @ λ=0.0100: Avg=8.76, Best=8.80
Gen  90 @ λ=0.0100: Avg=8.75, Best=8.80
Gen 100 @ λ=0.0100: Avg=8.75, Best=8.80
Gen 110 @ λ=0.0100: Avg=8.75, Best=8.80
Stopping evolve_once at gen 114: <1% improvement

--- Running GA with mutation rate = 0.0050 ---
Gen   1 @ λ=0.0050: Avg=4.16, Best=7.00
Gen  10 @ λ=0.0050: Avg=8.44, Best=8.80
Gen  20 @ λ=0.0050: Avg=8.76, Best=8.80
Gen  30 @ λ=0.0050: Avg=8.78, Best=8.80
Gen  40 @ λ=0.0050: Avg=8.78, Best=8.80
Gen  50 @ λ=0.0050: Avg=8.78, Best=8.80
Gen  60 @ λ=0.0050: Avg=8.77, Best=8.80
Gen  70 @ λ=0.0050: Avg=8.78, Best=8.80
Gen  80 @ λ=0.0050: Avg=8.76, Best=8.80
Gen  90 @ λ=0.0050: Avg=8.77, Best=8.80
Gen 100 @ λ=0.0050: Avg=8.77, Best=8.80
Gen 110 @ λ=0.0050: Avg=8.78, Best=8.80
Stopping evolve_once at gen 115: <1% improvement
No improvement at λ=0.0050; stopping adaptation.

Adaptive GA final best fitness: 8.80
Final schedule:
  SLA100A | Beach 301 @ 15:00 | Zeldin
  SLA100B | Frank 119 @ 13:00 | Zeldin
  SLA191A | Frank 119 @ 10:00 | Zeldin
  SLA191B | Loft 206 @ 10:00 | Zeldin
  SLA201 | Frank 119 @ 14:00 | Glen
  SLA291 | Beach 201 @ 10:00 | Banks
  SLA303 | Loft 310 @ 13:00 | Zeldin
  SLA304 | Slater 003 @ 15:00 | Glen
  SLA394 | Frank 119 @ 13:00 | Tyler
  SLA449 | Loft 310 @ 10:00 | Singer
  SLA451 | Loft 310 @ 10:00 | Singer

Process finished with exit code 0
```

Running test_fitness.py:



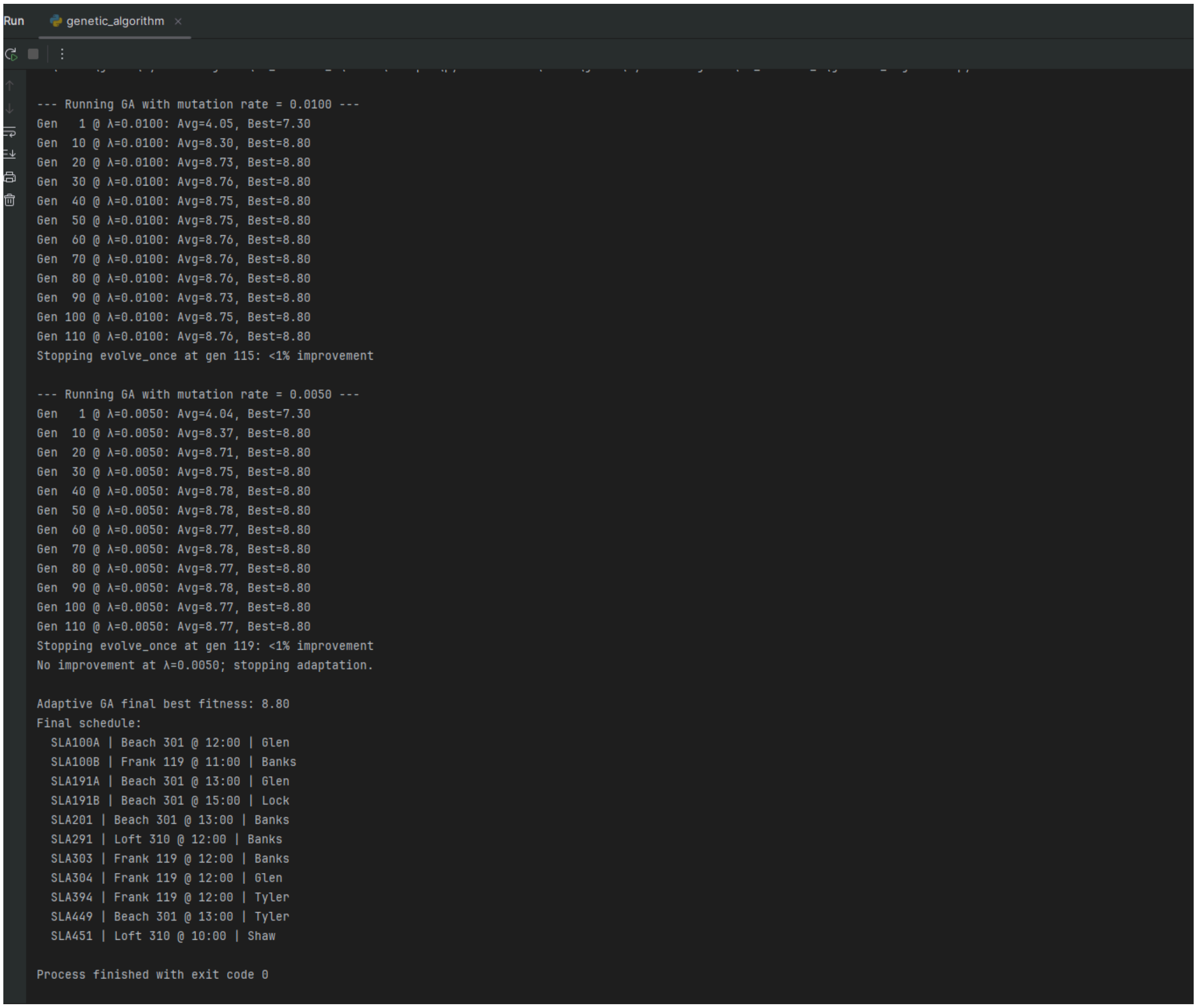
```
C:\Users\justJ\PycharmProjects\AI_PROJECT_2\.venv\Scripts\python.exe "C:/Program Files/JetBrains/PyCharm 2025.1/plugins/python-ce/helpers/pycharm/_jb_pytest_runner.py" --path C:\Us
Testing started at 4:50 PM ...
Launching pytest with arguments C:\Users\justJ\PycharmProjects\AI_PROJECT_2\test_fitness.py --no-header --no-summary -q in C:\Users\justJ\PycharmProjects\AI_PROJECT_2

============================= test session starts ==============================
collecting ... collected 9 items

test_fitness.py::test_score_room_too_small PASSED                        [ 11%]
test_fitness.py::test_score_room_medium PASSED                           [ 22%]
test_fitness.py::test_score_room_big PASSED                              [ 33%]
test_fitness.py::test_score_room_huge PASSED                             [ 44%]
test_fitness.py::test_score_pref_preferred PASSED                        [ 55%]
test_fitness.py::test_score_pref_other PASSED                            [ 66%]
test_fitness.py::test_score_pref_neither PASSED                          [ 77%]
test_fitness.py::test_activity_score_combines PASSED                     [ 88%]
test_fitness.py::test_schedule_fitness_sum PASSED                        [100%]

============================== 9 passed in 0.02s ===============================

Process finished with exit code 0
```

Running smoke_test.py:



```
C:\Users\justJ\PycharmProjects\AI_PROJECT_2\.venv\Scripts\python.exe C:\Users\justJ\PycharmProjects\AI_PROJECT_2\smoke_te
Minimum fitness: -3.10
Average fitness: 2.18
Maximum fitness: 6.60

Worst schedule assignments:
  SLA451 | Roman 216 @ 13:00 | Numen
  SLA291 | Roman 216 @ 14:00 | Numen
  SLA291 | Roman 216 @ 14:00 | Glen
  SLA191A | Loft 206 @ 13:00 | Zeldin
  SLA451 | Roman 201 @ 11:00 | Singer
  SLA451 | Frank 119 @ 13:00 | Lock
  SLA451 | Roman 201 @ 12:00 | Tyler
  SLA201 | Slater 003 @ 13:00 | Tyler
  SLA451 | Frank 119 @ 13:00 | Zeldin
  SLA191B | Slater 003 @ 11:00 | Shaw
  SLA291 | Slater 003 @ 12:00 | Tyler

Best schedule assignments:
  SLA291 | Loft 206 @ 15:00 | Lock
  SLA291 | Logos 325 @ 15:00 | Uther
  SLA303 | Beach 301 @ 15:00 | Numen
  SLA291 | Frank 119 @ 14:00 | Banks
  SLA191A | Roman 201 @ 10:00 | Zeldin
  SLA100A | Roman 201 @ 10:00 | Glen
  SLA394 | Roman 201 @ 10:00 | Richards
  SLA191A | Beach 201 @ 10:00 | Glen
  SLA100B | Roman 201 @ 13:00 | Zeldin
  SLA191B | Roman 201 @ 14:00 | Banks
  SLA201 | Loft 310 @ 10:00 | Richards


Process finished with exit code 0
```

Running the genetic_algorithm.py:



```
--- Running GA with mutation rate = 0.0100 ---
Gen   1 @ λ=0.0100: Avg=4.05, Best=7.30
Gen  10 @ λ=0.0100: Avg=8.30, Best=8.80
Gen  20 @ λ=0.0100: Avg=8.73, Best=8.80
Gen  30 @ λ=0.0100: Avg=8.76, Best=8.80
Gen  40 @ λ=0.0100: Avg=8.75, Best=8.80
Gen  50 @ λ=0.0100: Avg=8.75, Best=8.80
Gen  60 @ λ=0.0100: Avg=8.76, Best=8.80
Gen  70 @ λ=0.0100: Avg=8.76, Best=8.80
Gen  80 @ λ=0.0100: Avg=8.76, Best=8.80
Gen  90 @ λ=0.0100: Avg=8.73, Best=8.80
Gen 100 @ λ=0.0100: Avg=8.75, Best=8.80
Gen 110 @ λ=0.0100: Avg=8.76, Best=8.80
Stopping evolve_once at gen 115: <1% improvement

--- Running GA with mutation rate = 0.0050 ---
Gen   1 @ λ=0.0050: Avg=4.04, Best=7.30
Gen  10 @ λ=0.0050: Avg=8.37, Best=8.80
Gen  20 @ λ=0.0050: Avg=8.71, Best=8.80
Gen  30 @ λ=0.0050: Avg=8.75, Best=8.80
Gen  40 @ λ=0.0050: Avg=8.78, Best=8.80
Gen  50 @ λ=0.0050: Avg=8.78, Best=8.80
Gen  60 @ λ=0.0050: Avg=8.77, Best=8.80
Gen  70 @ λ=0.0050: Avg=8.78, Best=8.80
Gen  80 @ λ=0.0050: Avg=8.77, Best=8.80
Gen  90 @ λ=0.0050: Avg=8.78, Best=8.80
Gen 100 @ λ=0.0050: Avg=8.77, Best=8.80
Gen 110 @ λ=0.0050: Avg=8.77, Best=8.80
Stopping evolve_once at gen 119: <1% improvement
No improvement at λ=0.0050; stopping adaptation.

Adaptive GA final best fitness: 8.80
Final schedule:
  SLA100A | Beach 301 @ 12:00 | Glen
  SLA100B | Frank 119 @ 11:00 | Banks
  SLA191A | Beach 301 @ 13:00 | Glen
  SLA191B | Beach 301 @ 15:00 | Lock
  SLA201 | Beach 301 @ 13:00 | Banks
  SLA291 | Loft 310 @ 12:00 | Banks
  SLA303 | Frank 119 @ 12:00 | Banks
  SLA304 | Frank 119 @ 12:00 | Glen
  SLA394 | Frank 119 @ 12:00 | Tyler
  SLA449 | Beach 301 @ 13:00 | Tyler
  SLA451 | Loft 310 @ 10:00 | Shaw

Process finished with exit code 0
```