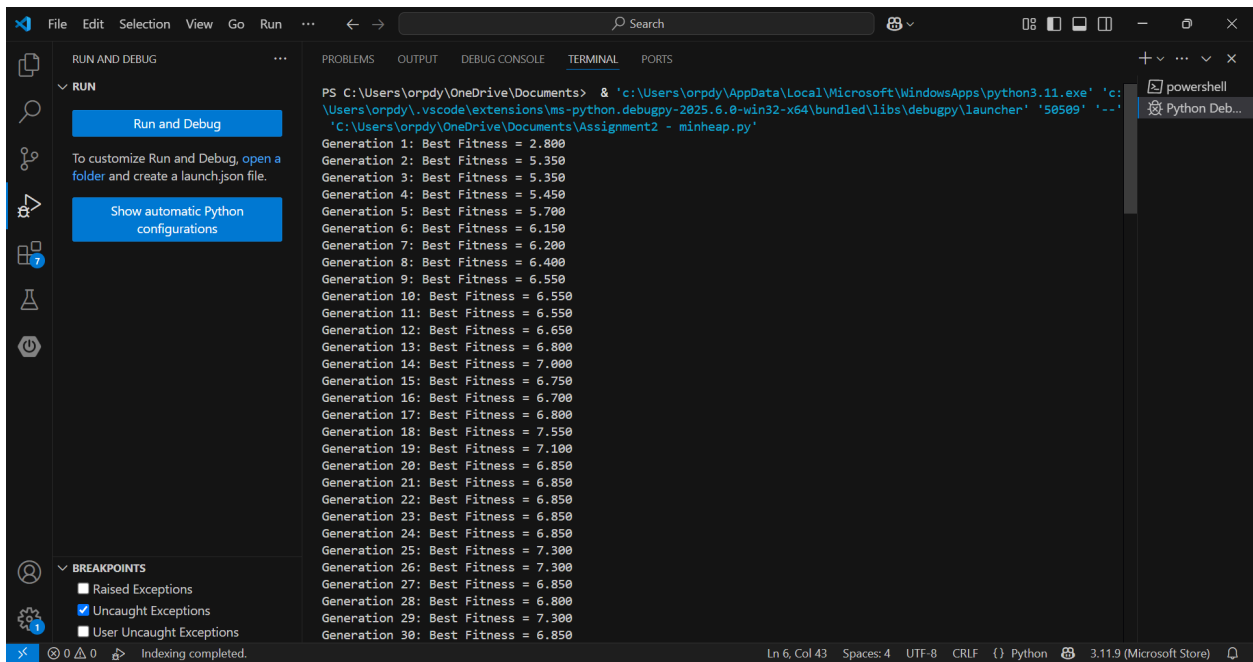
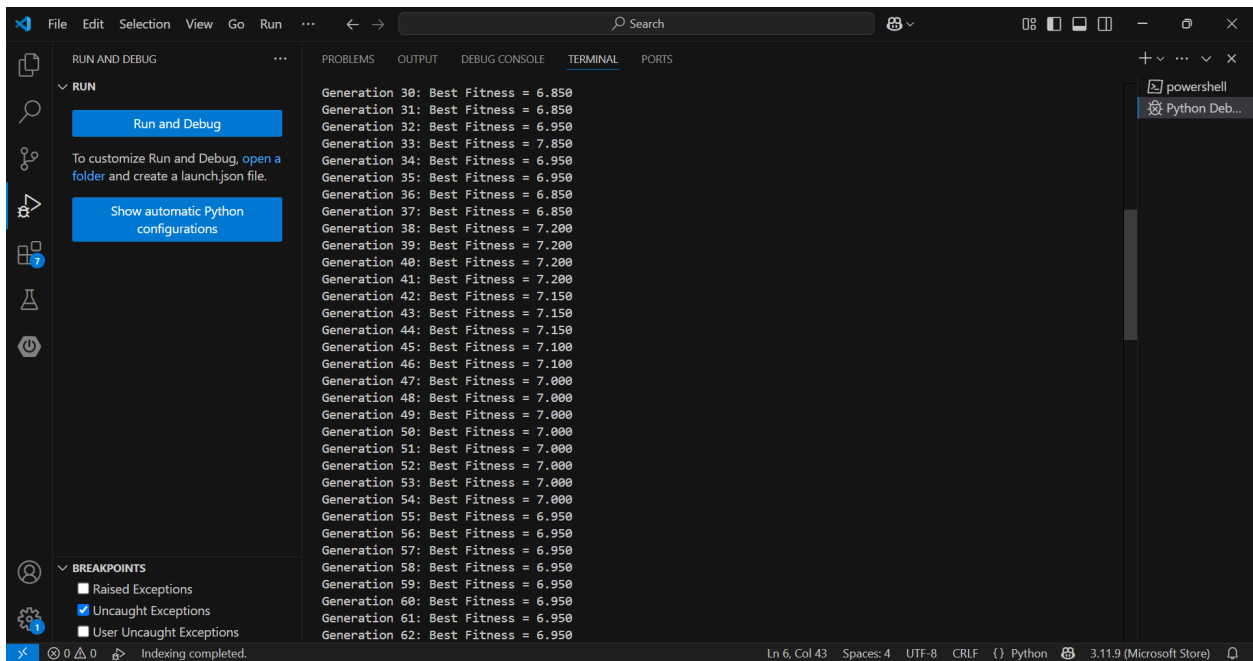


## GENETIC ALGORITHM WITH MINHEAP:

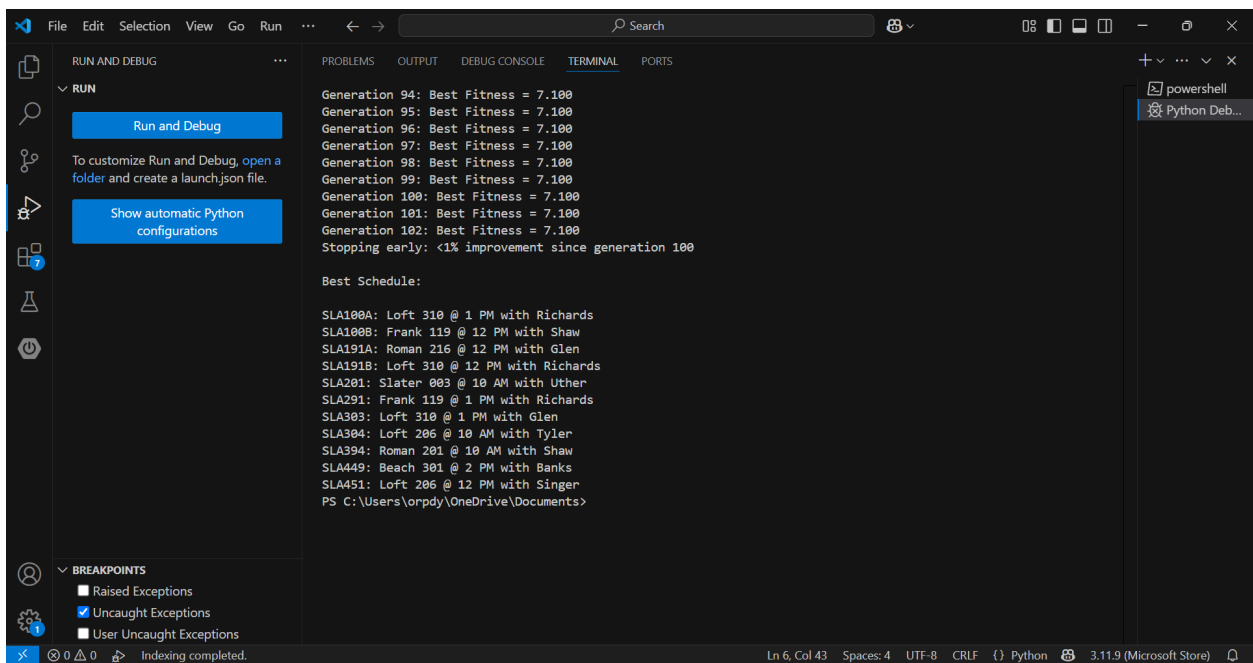
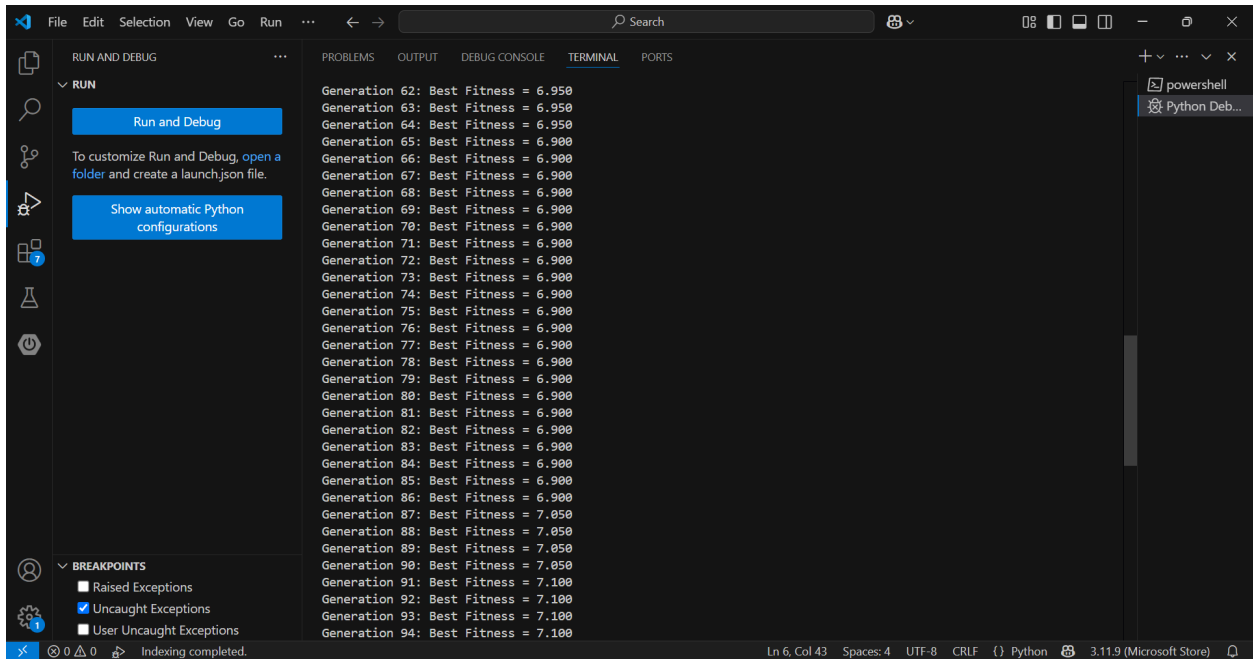


```
PS C:\Users\orpd\OneDrive\Documents> & 'c:\Users\orpd\AppData\Local\Microsoft\WindowsApps\python3.11.exe' 'c:\Users\orpd\.vscode\extensions\ms-python.debugpy-2025.6.0-win32-x64\bundled\libs\debugpy\launcher' '50509' '-.' 'C:\Users\orpd\OneDrive\Documents\Assignment2 - minheap.py'

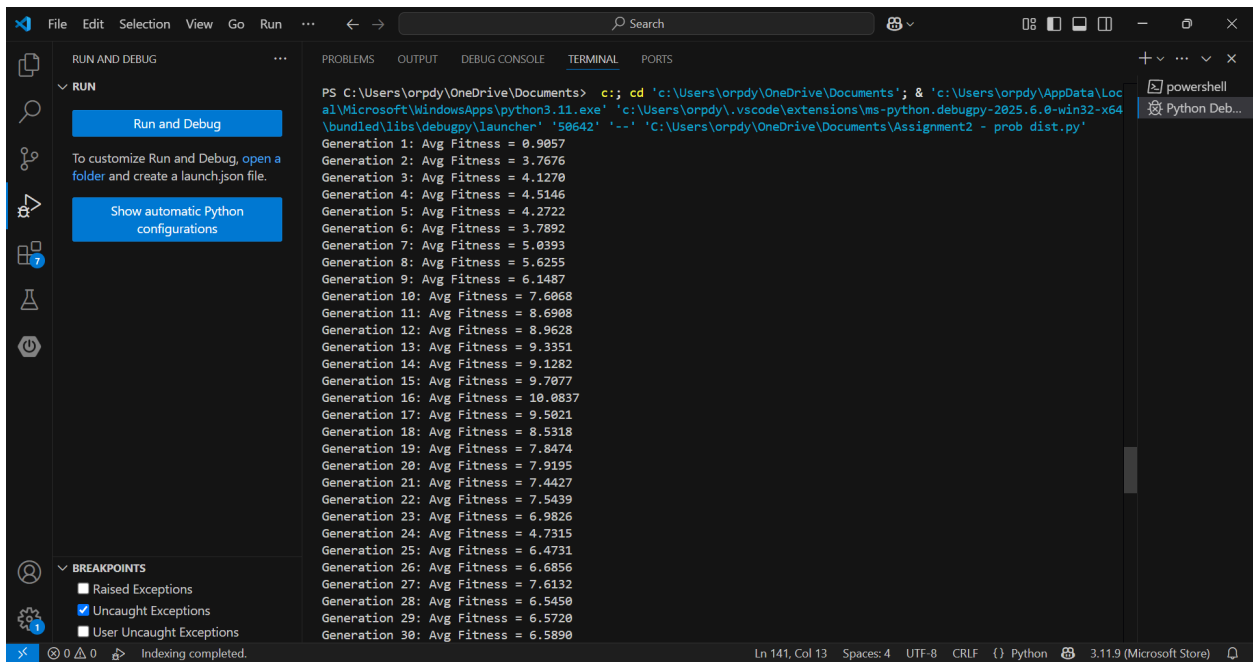
Generation 1: Best Fitness = 2.800
Generation 2: Best Fitness = 5.350
Generation 3: Best Fitness = 5.350
Generation 4: Best Fitness = 5.450
Generation 5: Best Fitness = 5.700
Generation 6: Best Fitness = 6.150
Generation 7: Best Fitness = 6.200
Generation 8: Best Fitness = 6.400
Generation 9: Best Fitness = 6.550
Generation 10: Best Fitness = 6.550
Generation 11: Best Fitness = 6.550
Generation 12: Best Fitness = 6.650
Generation 13: Best Fitness = 6.800
Generation 14: Best Fitness = 7.000
Generation 15: Best Fitness = 6.750
Generation 16: Best Fitness = 6.700
Generation 17: Best Fitness = 6.800
Generation 18: Best Fitness = 7.550
Generation 19: Best Fitness = 7.100
Generation 20: Best Fitness = 6.850
Generation 21: Best Fitness = 6.850
Generation 22: Best Fitness = 6.850
Generation 23: Best Fitness = 6.850
Generation 24: Best Fitness = 6.850
Generation 25: Best Fitness = 7.300
Generation 26: Best Fitness = 7.300
Generation 27: Best Fitness = 6.850
Generation 28: Best Fitness = 6.800
Generation 29: Best Fitness = 7.300
Generation 30: Best Fitness = 6.850
```



```
Generation 30: Best Fitness = 6.850
Generation 31: Best Fitness = 6.850
Generation 32: Best Fitness = 6.950
Generation 33: Best Fitness = 7.850
Generation 34: Best Fitness = 6.950
Generation 35: Best Fitness = 6.950
Generation 36: Best Fitness = 6.850
Generation 37: Best Fitness = 6.850
Generation 38: Best Fitness = 7.200
Generation 39: Best Fitness = 7.200
Generation 40: Best Fitness = 7.200
Generation 41: Best Fitness = 7.200
Generation 42: Best Fitness = 7.150
Generation 43: Best Fitness = 7.150
Generation 44: Best Fitness = 7.150
Generation 45: Best Fitness = 7.100
Generation 46: Best Fitness = 7.100
Generation 47: Best Fitness = 7.000
Generation 48: Best Fitness = 7.000
Generation 49: Best Fitness = 7.000
Generation 50: Best Fitness = 7.000
Generation 51: Best Fitness = 7.000
Generation 52: Best Fitness = 7.000
Generation 53: Best Fitness = 7.000
Generation 54: Best Fitness = 7.000
Generation 55: Best Fitness = 6.950
Generation 56: Best Fitness = 6.950
Generation 57: Best Fitness = 6.950
Generation 58: Best Fitness = 6.950
Generation 59: Best Fitness = 6.950
Generation 60: Best Fitness = 6.950
Generation 61: Best Fitness = 6.950
Generation 62: Best Fitness = 6.950
```

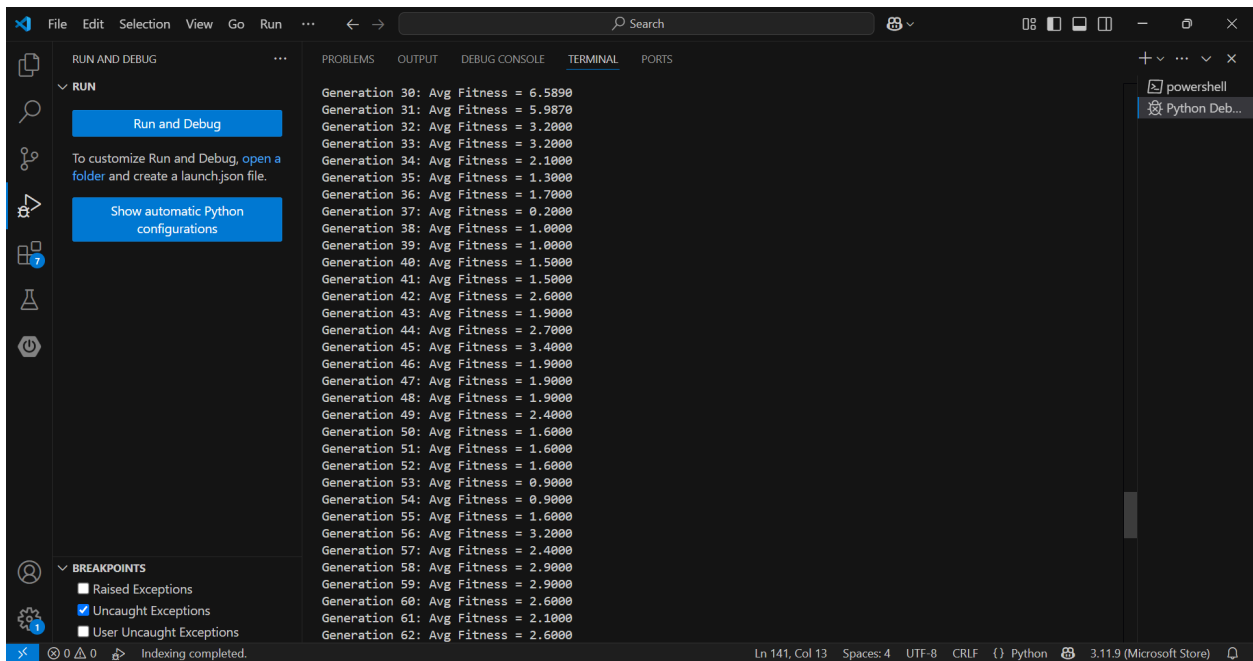


## GENETIC ALGORITHM WITH PROBABILITY DISTRIBUTION:



```
PS C:\Users\orpd\OneDrive\Documents> c:: cd 'c:\Users\orpd\OneDrive\Documents'; & 'c:\Users\orpd\AppData\Local\Microsoft\WindowsApps\python3.11.exe' 'c:\Users\orpd\.vscode\extensions\ms-python.debugpy-2025.6.0-win32-x64\bundle\libs\debugpy\launcher' '50642' '--' 'C:\Users\orpd\OneDrive\Documents\Assignment2 - prob dist.py'
```

Generation 1: Avg Fitness = 0.9057  
Generation 2: Avg Fitness = 3.7676  
Generation 3: Avg Fitness = 4.1270  
Generation 4: Avg Fitness = 4.5146  
Generation 5: Avg Fitness = 4.2722  
Generation 6: Avg Fitness = 3.7892  
Generation 7: Avg Fitness = 5.0393  
Generation 8: Avg Fitness = 5.6255  
Generation 9: Avg Fitness = 6.1487  
Generation 10: Avg Fitness = 7.6068  
Generation 11: Avg Fitness = 8.6908  
Generation 12: Avg Fitness = 8.9628  
Generation 13: Avg Fitness = 9.3351  
Generation 14: Avg Fitness = 9.1282  
Generation 15: Avg Fitness = 9.7077  
Generation 16: Avg Fitness = 10.0837  
Generation 17: Avg Fitness = 9.5021  
Generation 18: Avg Fitness = 8.5318  
Generation 19: Avg Fitness = 7.8474  
Generation 20: Avg Fitness = 7.9195  
Generation 21: Avg Fitness = 7.4427  
Generation 22: Avg Fitness = 7.5439  
Generation 23: Avg Fitness = 6.9826  
Generation 24: Avg Fitness = 4.7315  
Generation 25: Avg Fitness = 6.4731  
Generation 26: Avg Fitness = 6.6856  
Generation 27: Avg Fitness = 7.6132  
Generation 28: Avg Fitness = 6.5450  
Generation 29: Avg Fitness = 6.5720  
Generation 30: Avg Fitness = 6.5890



```
Generation 30: Avg Fitness = 6.5890  
Generation 31: Avg Fitness = 5.9870  
Generation 32: Avg Fitness = 3.2000  
Generation 33: Avg Fitness = 3.2000  
Generation 34: Avg Fitness = 2.1000  
Generation 35: Avg Fitness = 1.3000  
Generation 36: Avg Fitness = 1.7000  
Generation 37: Avg Fitness = 0.2000  
Generation 38: Avg Fitness = 1.0000  
Generation 39: Avg Fitness = 1.0000  
Generation 40: Avg Fitness = 1.5000  
Generation 41: Avg Fitness = 1.5000  
Generation 42: Avg Fitness = 2.6000  
Generation 43: Avg Fitness = 1.9000  
Generation 44: Avg Fitness = 2.7000  
Generation 45: Avg Fitness = 3.4000  
Generation 46: Avg Fitness = 1.9000  
Generation 47: Avg Fitness = 1.9000  
Generation 48: Avg Fitness = 1.9000  
Generation 49: Avg Fitness = 2.4000  
Generation 50: Avg Fitness = 1.6000  
Generation 51: Avg Fitness = 1.6000  
Generation 52: Avg Fitness = 1.6000  
Generation 53: Avg Fitness = 0.9000  
Generation 54: Avg Fitness = 0.9000  
Generation 55: Avg Fitness = 1.6000  
Generation 56: Avg Fitness = 3.2000  
Generation 57: Avg Fitness = 2.4000  
Generation 58: Avg Fitness = 2.9000  
Generation 59: Avg Fitness = 2.9000  
Generation 60: Avg Fitness = 2.6000  
Generation 61: Avg Fitness = 2.1000  
Generation 62: Avg Fitness = 2.6000
```

Visual Studio Code interface showing the first part of a genetic algorithm run. The terminal displays average fitness values for generations 62 through 94. The left sidebar shows the 'RUN AND DEBUG' panel with 'RUN' and 'BREAKPOINTS' sections.

```
Generation 62: Avg Fitness = 2.6000
Generation 63: Avg Fitness = 2.6000
Generation 64: Avg Fitness = 1.8000
Generation 65: Avg Fitness = 2.8000
Generation 66: Avg Fitness = 2.8000
Generation 67: Avg Fitness = 2.8000
Generation 68: Avg Fitness = 2.2500
Generation 69: Avg Fitness = 3.2500
Generation 70: Avg Fitness = 4.2500
Generation 71: Avg Fitness = 2.8500
Generation 72: Avg Fitness = 2.8500
Generation 73: Avg Fitness = 3.0500
Generation 74: Avg Fitness = 3.2500
Generation 75: Avg Fitness = 3.5500
Generation 76: Avg Fitness = 4.1500
Generation 77: Avg Fitness = 4.1500
Generation 78: Avg Fitness = 3.3500
Generation 79: Avg Fitness = 3.3500
Generation 80: Avg Fitness = 2.2000
Generation 81: Avg Fitness = 2.2000
Generation 82: Avg Fitness = 1.4000
Generation 83: Avg Fitness = 2.2000
Generation 84: Avg Fitness = 0.4500
Generation 85: Avg Fitness = 0.1500
Generation 86: Avg Fitness = 0.1500
Generation 87: Avg Fitness = 0.1500
Generation 88: Avg Fitness = -0.2500
Generation 89: Avg Fitness = 0.7500
Generation 90: Avg Fitness = -0.0500
Generation 91: Avg Fitness = -0.8500
Generation 92: Avg Fitness = -1.2500
Generation 93: Avg Fitness = -1.2500
Generation 94: Avg Fitness = -2.9500
```

Visual Studio Code interface showing the second part of a genetic algorithm run. The terminal displays average fitness values for generations 94 through 102, followed by a 'Stopping early' message and a 'Best Schedule' output. The left sidebar shows the 'RUN AND DEBUG' panel with 'RUN' and 'BREAKPOINTS' sections.

```
Generation 94: Avg Fitness = -2.9500
Generation 95: Avg Fitness = -1.8500
Generation 96: Avg Fitness = 0.8500
Generation 97: Avg Fitness = 1.5500
Generation 98: Avg Fitness = 1.5500
Generation 99: Avg Fitness = 2.0500
Generation 100: Avg Fitness = 3.7500
Generation 101: Avg Fitness = 3.7500
Generation 102: Avg Fitness = 2.7000
Stopping early: <1% improvement since generation 100

Best Schedule (Fitness = 2.70):
{'activity': 'SLA100A', 'room': 'Logos 325', 'time': '11 AM', 'facilitator': 'Tyler'}
{'activity': 'SLA100B', 'room': 'Frank 119', 'time': '10 AM', 'facilitator': 'Singer'}
{'activity': 'SLA191A', 'room': 'Loft 206', 'time': '12 PM', 'facilitator': 'Numen'}
{'activity': 'SLA191B', 'room': 'Loft 310', 'time': '11 AM', 'facilitator': 'Shaw'}
{'activity': 'SLA201', 'room': 'Roman 201', 'time': '2 PM', 'facilitator': 'Numen'}
{'activity': 'SLA291', 'room': 'Slater 003', 'time': '3 PM', 'facilitator': 'Richards'}
{'activity': 'SLA303', 'room': 'Frank 119', 'time': '2 PM', 'facilitator': 'Shaw'}
{'activity': 'SLA304', 'room': 'Loft 206', 'time': '11 AM', 'facilitator': 'Shaw'}
{'activity': 'SLA394', 'room': 'Roman 216', 'time': '1 PM', 'facilitator': 'Zeldin'}
{'activity': 'SLA449', 'room': 'Beach 301', 'time': '1 PM', 'facilitator': 'Tyler'}
{'activity': 'SLA451', 'room': 'Slater 003', 'time': '3 PM', 'facilitator': 'Singer'}
PS C:\Users\orply\OneDrive\Documents>
```