BIRZEIT UNIVERSITY

Faculty of Engineering & Technology
Department of Electrical & Computer Engineering
ENCS3390: Operating System Concepts
First Semester, 2024/2025

Programming Task 2

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Test case 1 (without deadlock):

```
1    0    0    1    CPU{50}
2    1    0    1    CPU{10}
3    2    0    1    CPU{20}
4    |
```

Run   main ×

```
Time 20: Process P2 executing CPU burst of 10.
Time 30: Process P0 executing CPU burst of 10.
Time 40: Process P2 executing CPU burst of 10.
Time 50: Process P2 completed.
Time 50: Process P0 executing CPU burst of 10.
Time 60: Process P0 executing CPU burst of 10.
Time 70: Process P0 executing CPU burst of 10.
Time 80: Process P0 completed.

Gantt Chart:
P0 (0-10)
P1 (10-20)
P2 (20-30)
P0 (30-40)
P2 (40-50)
P0 (50-60)
P0 (60-70)
P0 (70-80)

Average Waiting Time: 23.33
Average Turnaround Time: 50.00
```

```
1   0 0 0 CPU{10} IO{30} CPU{10}
2   1 0 0 CPU{20}
3
```

Run   main ×

```
Time 50: Process P0 completed.

Gantt Chart:
P0 (0-10)
P1 (10-20)
P1 (20-30)
Pidle (30-40)
P0 (40-50)

Average Waiting Time: 15.00
Average Turnaround Time: 40.00

Process finished with exit code 0
```

```
1     0    0    1    CPU{30}
2     1    1    1    CPU{10}
3     2    2    1    CPU{20}
4
```
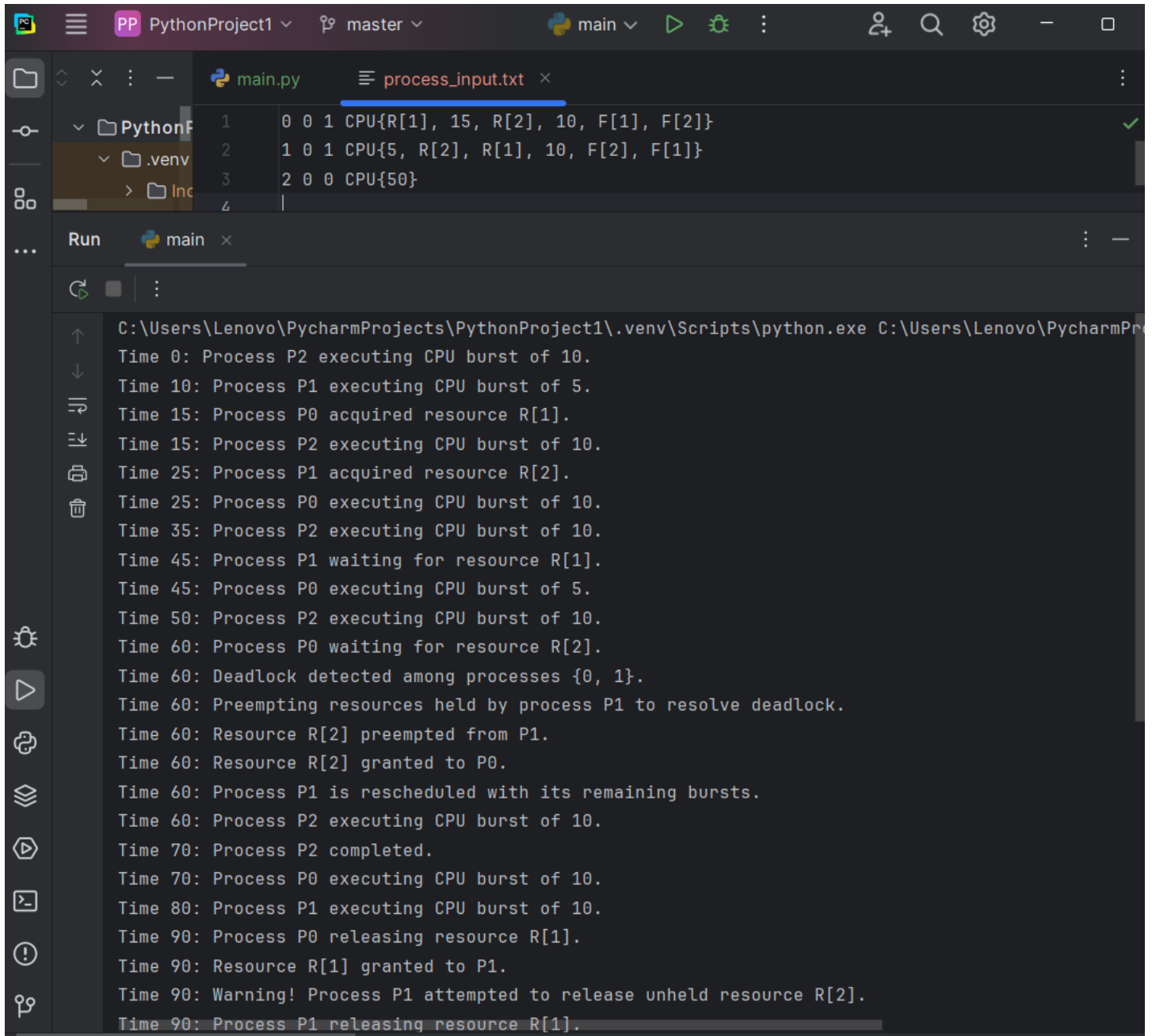
Run   main ×

```
C:\Users\Lenovo\PycharmProjects\PythonProject1\.venv\Scripts\python.exe C:\Users\Lenovo\PycharmProj
Time 0: Process P0 executing CPU burst of 10.
Time 10: Process P1 executing CPU burst of 10.
Time 20: Process P1 completed.
Time 20: Process P2 executing CPU burst of 10.
Time 30: Process P0 executing CPU burst of 10.
Time 40: Process P2 executing CPU burst of 10.
Time 50: Process P2 completed.
Time 50: Process P0 executing CPU burst of 10.
Time 60: Process P0 completed.

Gantt Chart:
P0 (0-10)
P1 (10-20)
P2 (20-30)
P0 (30-40)
P2 (40-50)
P0 (50-60)

Average Waiting Time: 23.33
Average Turnaround Time: 42.33
```

Test case 2 (with deadlock):


```
C:\Users\Lenovo\PycharmProjects\PythonProject1\.venv\Scripts\python.exe C:\Users\Lenovo\PycharmPr
Time 0: Process P2 executing CPU burst of 10.
Time 10: Process P1 executing CPU burst of 5.
Time 15: Process P0 acquired resource R[1].
Time 15: Process P2 executing CPU burst of 10.
Time 25: Process P1 acquired resource R[2].
Time 25: Process P0 executing CPU burst of 10.
Time 35: Process P2 executing CPU burst of 10.
Time 45: Process P1 waiting for resource R[1].
Time 45: Process P0 executing CPU burst of 5.
Time 50: Process P2 executing CPU burst of 10.
Time 60: Process P0 waiting for resource R[2].
Time 60: Deadlock detected among processes {0, 1}.
Time 60: Preempting resources held by process P1 to resolve deadlock.
Time 60: Resource R[2] preempted from P1.
Time 60: Resource R[2] granted to P0.
Time 60: Process P1 is rescheduled with its remaining bursts.
Time 60: Process P2 executing CPU burst of 10.
Time 70: Process P2 completed.
Time 70: Process P0 executing CPU burst of 10.
Time 80: Process P1 executing CPU burst of 10.
Time 90: Process P0 releasing resource R[1].
Time 90: Resource R[1] granted to P1.
Time 90: Warning! Process P1 attempted to release unheld resource R[2].
Time 90: Process P1 releasing resource R[1].
```

process_input.txt

```
1   0 0 1 CPU{R[1], 10, R[2], 10, F[1], F[2]}
2   1 0 1 CPU{R[2], 10, R[1], 10, F[2], F[1]}
3
```

Run — main

```
C:\Users\Lenovo\PycharmProjects\PythonProject1\.venv\Scripts\python.exe C:\Users\Lenovo\PycharmPr
Time 0: Process P0 acquired resource R[1].
Time 0: Process P1 acquired resource R[2].
Time 0: Process P0 executing CPU burst of 10.
Time 10: Process P1 executing CPU burst of 10.
Time 20: Process P0 waiting for resource R[2].
Time 20: Process P1 waiting for resource R[1].
Time 20: Deadlock detected among processes {0, 1}.
Time 20: Preempting resources held by process P1 to resolve deadlock.
Time 20: Resource R[2] preempted from P1.
Time 20: Resource R[2] granted to P0.
Time 20: Process P1 is rescheduled with its remaining bursts.
Time 20: Process P0 executing CPU burst of 10.
Time 30: Process P1 executing CPU burst of 10.
Time 40: Process P0 releasing resource R[1].
Time 40: Resource R[1] granted to P1.
```

```
Gantt Chart:
P2 (0-10)
P1 (10-15)
P2 (15-25)
P0 (25-35)
P2 (35-45)
P0 (45-50)
P2 (50-60)
P2 (60-70)
P0 (70-80)
P1 (80-90)

Average Waiting Time: 20.00
```