



**Faculty of Engineering and Technology  
Electrical and Computer Engineering Department**

**Computer Design Lab  
ENCS4110**

**Project 2**

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Section: **1**

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## Test cases:

### 1) No deadlock:

**First case:** input file same as it was in the project  
time quanta = 20

```
processes × main.py
1 0 0 1 CPU {R[0], 50, F[0]}
2
3 1 5 1 CPU {20} IO{30} CPU {20, R[1], 30, F[1], 10}
4

n main ×
:
C:\Users\User\PycharmProjects\osproj\.venv\Scripts\python.exe C:\Users\User\PycharmProjects\osproj\main.py
processes: [[0, 0, 1, 50, 0, 0], [1, 5, 1, 20, 30, 60]]
number resources= 2, number process= 2
request [[0, 0, 0, 50, 1], [1, 1, 20, 30, 2]]

Gantt chart: [0, 1, 0, 0, 1, 1, 1]

Completed processes:
0:
  Finished at: 70
  Turnaround Time: 70
  Waiting Time: 20
1:
  Finished at: 130
  Turnaround Time: 125
  Waiting Time: 15

Average waiting time: 17.5
Average turnaround time: 97.5
-----
```

**second case:** two processes asking for the same recourse at the same time:

time quanta = 20

```
processes x main.py
1 0 0 1 CPU {R[0], 50, F[0]}
2
3 1 1 1 CPU {R[0], 50, F[0]}
4

n main x
:
C:\Users\User\PycharmProjects\osproj\.venv\Scripts\python.exe C:\Users\User\PycharmProjects\osproj\main.py
processes: [[0, 0, 1, 50, 0, 0], [1, 1, 1, 50, 0, 0]]
number resources= 1, number process= 2
request [[0, 0, 0, 50, 1], [0, 1, 0, 50, 1]]

Gantt chart: [0, 0, 0, 1, 1, 1]

Completed processes:
0:
  Finished at: 50
  Turnaround Time: 50
  Waiting Time: 0
1:
  Finished at: 100
  Turnaround Time: 99
  Waiting Time: 49

Average waiting time: 24.5
Average turnaround time: 74.5
-----
```

### third case:

time quanta = 10

#### Test case 1 (without deadlock):

PID	Arrival Time	Priority	CPU / IO Bursts
0	0	0	CPU{10} IO{30} CPU{10}
1	0	0	CPU{20}

Gantt Chart

0	P0	10	P1	30	idle	40	P0	50
---	----	----	----	----	------	----	----	----

```
processes x main.py
1 0 0 0 CPU {10} IO{30} CPU {10}
2
3 1 0 0 CPU {20}
4
n main x
:
C:\Users\User\PycharmProjects\osproj\.venv\Scripts\python.exe C:\Users\User\PycharmProjects\osproj\main.py
processes: [[0, 0, 0, 10, 30, 10], [1, 0, 0, 20, 0, 0]]
number resources= 0, number process= 2
request []

Gantt chart: [0, 1, 1, 'idle', 'idle', 'idle', 'idle', 'idle', 'idle', 'idle', 'idle', 'idle', 'idle', 0]

Completed processes:
1:
  Finished at: 30
  Turnaround Time: 30
  Waiting Time: 10
0:
  Finished at: 50
  Turnaround Time: 50
  Waiting Time: 0

Average waiting time: 5.0
Average turnaround time: 40.0
-----
Process finished with exit code 0
```

Here we have 10 idle each one unit time (idle is 1 sec)

## Forth case:

Time quanta: 20

```
processes x main.py
1 0 0 1 CPU {R[0], 60, R[1], 20, F[0], F[1]}
2
3
4 2 5 1 CPU {20} IO{20} CPU {20, R[1], 30, F[1], 10}
5

n main x
:
C:\Users\User\PycharmProjects\osproj\.venv\Scripts\python.exe C:\Users\User\PycharmProjects\osproj\main.py
processes: [[0, 0, 1, 80, 0, 0], [2, 5, 1, 20, 20, 60]]
number resources= 2, number process= 2
request: [[0, 0, 0, 80, 1], [1, 0, 60, 20, 1], [1, 2, 20, 30, 2]]

Gantt chart: [0, 2, 0, 2, 0, 2, 2, 0]

Completed processes:
2:
  Finished at: 140
  Turnaround Time: 135
  Waiting Time: 35
0:
  Finished at: 160
  Turnaround Time: 160
  Waiting Time: 80

Average waiting time: 57.5
Average turnaround time: 147.5
-----
```

## 2) Deadlock and recovery:

### First case:

Time quanta 10

```
1 0 0 1 CPU {R[0], 15, R[1], 10, F[0], F[1]}
2
3 1 0 1 CPU {R[1], 15, R[0], 10, F[1], F[0]}
4
5 2 0 0 CPU {50}
6
7 |

processes: [[0, 0, 1, 25, 0, 0], [1, 0, 1, 25, 0, 0], [2, 0, 0, 50, 0, 0]]
number resources= 2, number process= 3
request: [[0, 0, 0, 25, 1], [1, 0, 15, 10, 1], [1, 1, 0, 25, 1], [0, 1, 15, 10, 1]]

Deadlock detected! Process 1 is waiting for resource 0 held by blocked process 0
Deadlock detected! Process 0 is waiting for resource 1 held by blocked process 1
Deadlock processes [0, 1]
At time 80
Recovery:
Terminating process 0 to break the deadlock.

Gantt chart: [2, 2, 2, 2, 2, 0, 1, 0, 1, 1, 0, 0, 0]

Completed processes:
2:
  Finished at: 50
  Turnaround Time: 50
  Waiting Time: 0
1:
  Finished at: 90
  Turnaround Time: 90
  Waiting Time: 65
0:
  Finished at: 115
  Turnaround Time: 115
  Waiting Time: 90

Average waiting time: 51.666666666666664
Average turnaround time: 85.0
```

## Second case:

Time quanta: 20

```
1 0 0 1 CPU {R[0], 20, R[1], 20, F[0], F[1]}
2
3 1 0 1 CPU {R[1], 20, R[0], 20, F[1], F[0]}
4
5 2 5 2 CPU {20} IO{5} CPU {20, R[1], 30, F[1], 10}
```

main x

```
C:\Users\User\PycharmProjects\osproj\.venv\Scripts\python.exe C:\Users\User\PycharmProjects\osproj\main.py
processes: [[0, 0, 1, 40, 0, 0], [1, 0, 1, 40, 0, 0], [2, 5, 2, 20, 5, 60]]
number resources= 2, number process= 3
request: [[0, 0, 0, 40, 1], [1, 0, 20, 20, 1], [1, 1, 0, 40, 1], [0, 1, 20, 20, 1], [1, 2, 20, 30, 2]]

Deadlock detected! Process 1 is waiting for resource 0 held by blocked process 0
Deadlock detected! Process 0 is waiting for resource 1 held by blocked process 1
Deadlock processes [0, 1]
At time 40
Recovery:
Terminating process 0 to break the deadlock.

Gantt chart: [0, 1, 0, 1, 1, 0, 0, 2, 'idle', 'idle', 'idle', 'idle', 'idle', 2, 2, 2]

Completed processes:
1:
  Finished at: 60
  Turnaround Time: 60
  Waiting Time: 20
0:
  Finished at: 100
  Turnaround Time: 100
  Waiting Time: 60

Terminating process 0 to break the deadlock.

Gantt chart: [0, 1, 0, 1, 1, 0, 0, 2, 'idle', 'idle', 'idle', 'idle', 'idle', 2, 2, 2]

Completed processes:
1:
  Finished at: 60
  Turnaround Time: 60
  Waiting Time: 20
0:
  Finished at: 100
  Turnaround Time: 100
  Waiting Time: 60
2:
  Finished at: 185
  Turnaround Time: 180
  Waiting Time: 95

Average waiting time: 58.33333333333333
Average turnaround time: 113.33333333333333
-----
```

**For the discussion:**

0	0	1	CPU {R[0], 50, F[0]}		
1	5	1	CPU {20}	IO{30}	CPU {34, R[1], 30, F[1], 10}
2	6	3	CPU {20, R[2], 30, F[2], 10}		
3	4	2	CPU {15}	IO{32}	CPU {25}
5	5	1	CPU {70}	IO{30}	CPU {R[3], 45, F[3]}
6	10	4	CPU {R[0], 20, R[1], 20, F[0], F[1]}		