El-Oued University - Faculty of Exact Sciences
Department of Mathematics and Computer science
First-year Master in Internet of Things & Cybersecurity

Real Time Systems **2024 - 2025**

Exam Correction

Exercise 01: 4 points

Schedulability Analysis with EDF:

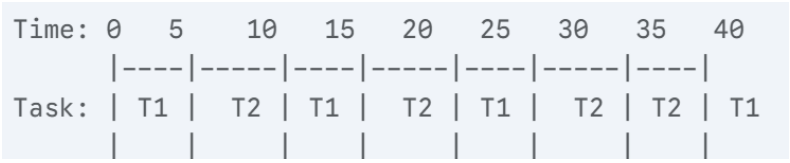
$$\sum_{i=1}^{n} \frac{C_i}{D_i} \leq 1$$

In our case, n=2:

C1/D1 + C2/D2 = 5/10 +20/40 = 0.5 + 0.5 = 1 **2**

Since the utilization factor is equal to 1, the task set is theoretically schedulable under EDF. This means that if EDF is correctly implemented, all deadlines will be met.

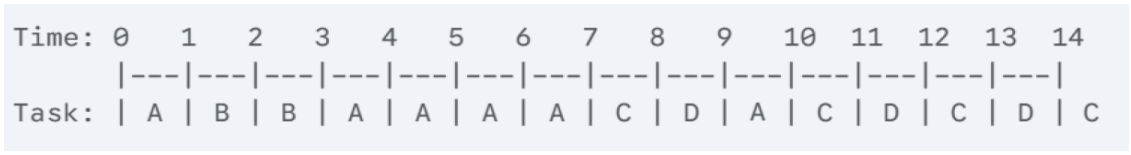
Gantt Chart for EDF Scheduling:



2

Exercise 02: 6 points

Gantt Chart for Aging with preemption



3

Turnaround Time (TT) and Waiting Time (WT)

Tasks	Arrival Time (AT)	Execution Time (ET)	Completion Time (CT)	Turnaround Time (TT=CT-AT)	Waiting Time (WT=TT-ET)
A	0	6	10	10	4
B	1	2	3	2	0
C	3	4	15	12	8
D	5	3	14	9	6

Average Turnaround Time:
Average TT = (10 + 2 + 12 + 9) / 4 = 33 / 4 = **8.25** **1.5**

Average Waiting Time:
Average WT = (4 + 0 + 8 + 6) / 4 = 18 / 4 = **4.5** **1.5**

Exercise 03: 6 points

2

```
Declaration: Semaphores and Variables
Semaphore gate = 1;

Semaphore mutexFC = 1;
Semaphore economyCanBoard = 0;
Integer numFirstClass = N ; // Total number of first-class
passengers
Integer firstClassCount = 0;
```

2.5

```
Process FCP ()    // First Class Passenger Process
P(gate)
BoardPlane()
V(gate)
P(mutexFC)
firstClassCount = firstClassCount + 1
if firstClassCount == numFirstClass:
  V(economyCanBoard)
V(mutexFC)
```

1.5

```
Process ECP() // Economy Class Passenger Process
P(economyCanBoard)
P(gate)
BoardPlane()
V(gate)
```

Exercise 04: 4 points

1.5

```
Declaration: Semaphores

Semaphore washingBay = 1;
Semaphore dryingBooth = 1;
Semaphore washComplete = 0;
```

2.5

```
Process Car():
P(washingBay)
Wash()
V(washingBay)
V(washComplete)
P(washComplete)
P(dryingBooth)
Dry()
V(dryingBooth)
```