

CSC-27 – Computação Distribuída

Laboratório 2: Algoritmo de Ricart-Agrawala para exclusão mútua

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Testes Realizados

Para validar o funcionamento correto do algoritmo de Ricart-Agrawala, realizamos uma série de testes com três processos simultâneos. Os cenários abaixo demonstram como o algoritmo lida com diferentes situações de requisição e liberação da seção crítica (Critical Section - CS).

Caso 1: Um processo solicita a CS. Após liberá-la, outro processo solicita a CS.

- P1 solicita a CS.
- P1 usa a CS e depois a libera.
- P2 usa a CS e depois a libera.

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\SharedResource.exe
Processo 1 (127.0.0.1:64050) enviou a mensagem "Hello, CS!" com clock 1
```

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 1 :10002 :10003 :10004

+-----+
|  RELEASED  |
+-----+
x

+-----+
|  WANTED  |
+-----+

Requesting access to the critical section (sending requests)... | Clock: 1
Reply received from process 3 | Total replies: 1
Reply received from process 2 | Total replies: 2

+-----+
|  HELD  |
+-----+

Entering critical section through port 64050

+-----+
|  RELEASED  |
+-----+

Releasing the critical section...
```

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 2 :10002 :10003 :10004

+-----+
|  RELEASED  |
+-----+

Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
```

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 3 :10002 :10003 :10004

+-----+
|  RELEASED  |
+-----+

Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
```

Windows PowerShell

PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\SharedResource> .\SharedResource.exe
Processo 1 (127.0.0.1:64050) enviou a mensagem "Hello, CS!" com clock 1
Processo 2 (127.0.0.1:64053) enviou a mensagem "Hello, CS!" com clock 3

Windows PowerShell

PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 1 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
x

+-----+
| WANTED |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 1
Reply received from process 3 | Total replies: 1
Reply received from process 2 | Total replies: 2

+-----+
| HELD |
+-----+
Entering critical section through port 64050

+-----+
| RELEASED |
+-----+
Releasing the critical section...
Received 'request' from process 2 with clock 3 | Current clock: 4
Sending immediate reply to process 2

Windows PowerShell

PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 2 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
x

+-----+
| WANTED |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 3
Reply received from process 3 | Total replies: 1
Reply received from process 1 | Total replies: 2

+-----+
| HELD |
+-----+
Entering critical section through port 64053

+-----+
| RELEASED |
+-----+
Releasing the critical section...

Windows PowerShell

PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 3 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
Received 'request' from process 2 with clock 3 | Current clock: 4
Sending immediate reply to process 2

Caso 2: Um processo solicita a CS enquanto outro processo está usando a CS

- P2 solicita a CS enquanto P1 está utilizando a CS

Aqui, podemos verificar que o request de P2 chega em P1 enquanto o P1 está HELD (usando a CS)

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\SharedResource.exe
Processo 1 (127.0.0.1:55432) enviou a mensagem "Hello, CS!" com clock 1
```

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 1 :10002 :10003 :10004
```

```
+-----+
| RELEASED |
+-----+
x

+-----+
| WANTED |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 1
Reply received from process 2 | Total replies: 1
Reply received from process 3 | Total replies: 2

+-----+
| HELD |
+-----+
Entering critical section through port 55432
Received 'request' from process 2 with clock 3 | Current clock: 4
Queuing request from process 2 (clock = 3)
```

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 2 :10002 :10003 :10004
```

```
+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
x

+-----+
| WANTED |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 3
Reply received from process 3 | Total replies: 1
```

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 3 :10002 :10003 :10004
```

```
+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
Received 'request' from process 2 with clock 3 | Current clock: 4
Sending immediate reply to process 2
```

Após sair de HELD, ele consulta sua queue e da reply para o request de P2, permitindo P2 a entrar na CS

```
Windows PowerShell
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\SharedResource> .\SharedResource.exe
Processo 1 (127.0.0.1:55432) enviou a mensagem "Hello, CS!" com clock 1
Processo 1 (127.0.0.1:55435) enviou a mensagem "Hello, CS!" com clock 3

Windows PowerShell
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 1 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
x

+-----+
| WANTED   |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 1
Reply received from process 2 | Total replies: 1
Reply received from process 3 | Total replies: 2

+-----+
| HELD     |
+-----+
Entering critical section through port 55432
Received 'request' from process 2 with clock 3 | Current clock: 4
Queueing request from process 2 (clock = 3)

+-----+
| RELEASED |
+-----+
Releasing the critical section...
Sending reply to process 2

Windows PowerShell
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 2 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
x

+-----+
| WANTED   |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 3
Reply received from process 3 | Total replies: 1
Reply received from process 1 | Total replies: 2

+-----+
| HELD     |
+-----+
Entering critical section through port 55435

+-----+
| RELEASED |
+-----+
Releasing the critical section...

Windows PowerShell
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 3 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
Received 'request' from process 2 with clock 3 | Current clock: 4
Sending immediate reply to process 2
```

Caso 3: Processo com requisição anterior tem preferência para acessar a Seção Crítica

- P1 solicita a CS (está WANTED)
- P2 também solicita a CS (está WANTED)
- P3 da REPLY para ambas as requisições
- Como P1 fez a solicitação com menor clock, ele entrará na CS primeiro, e logo após, o P2 entrará.

P1 e P2 entram em WANTED ao mesmo tempo. Note que P1 recebe de P2 um request com clock 5, sendo que o clock que ele tinha quando mandou request para a CS era 1... logo ele tem preferência e da enqueue no request recebido. Já P2, recebe de P1 o request de clock 1, sendo que enviou um request com clock 5... logo, ele sabe que não tem prioridade.

```
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\SharedResource> .\SharedResource.exe
Processo 1 (127.0.0.1:55674) enviou a mensagem "Hello, CS!" com clock 6

PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 1 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
x

+-----+
| WANTED |
+-----+

Requesting access to the critical section (sending requests)... | Clock: 1
Reply received from process 3 | Total replies: 1
Reply received from process 2 | Total replies: 2
Received 'request' from process 2 with clock 5 | Current clock: 6
Queuing request from process 2 (clock = 5)

+-----+
| HELD |
+-----+

Entering critical section through port 55674

PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 2 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
2
Internal event! | Clock: 1
2
Internal event! | Clock: 2
2
Internal event! | Clock: 3
Received 'request' from process 1 with clock 1 | Current clock: 4
Sending immediate reply to process 1
x

+-----+
| WANTED |
+-----+

Requesting access to the critical section (sending requests)... | Clock: 5
Reply received from process 3 | Total replies: 1

PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 3 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
Received 'request' from process 2 with clock 5 | Current clock: 6
Sending immediate reply to process 2
```

Após sair da CS, o P1 consulta sua queue de requests e da reply em todos eles. O P2, então, pode entrar na CS com este reply que estava faltando

```
Windows PowerShell
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\SharedResource> .\SharedResource.exe
Processo 1 (127.0.0.1:55674) enviou a mensagem "Hello, CS!" com clock 6
Processo 2 (127.0.0.1:59458) enviou a mensagem "Hello, CS!" com clock 5

Windows PowerShell
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 1 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
x

+-----+
| WANTED   |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 1
Reply received from process 3 | Total replies: 1
Reply received from process 2 | Total replies: 2
Received 'request' from process 2 with clock 5 | Current clock: 6
Queuing request from process 2 (clock = 5)

+-----+
| HELD     |
+-----+
Entering critical section through port 55674

+-----+
| RELEASED |
+-----+
Releasing the critical section...
Sending reply to process 2

Windows PowerShell
+-----+
2
Internal event! | Clock: 1
2
Internal event! | Clock: 2
2
Internal event! | Clock: 3
Received 'request' from process 1 with clock 1 | Current clock: 4
Sending immediate reply to process 1
x

+-----+
| WANTED   |
+-----+
Requesting access to the critical section (sending requests)... | Clock: 5
Reply received from process 3 | Total replies: 1
Reply received from process 1 | Total replies: 2

+-----+
| HELD     |
+-----+
Entering critical section through port 59458

+-----+
| RELEASED |
+-----+
Releasing the critical section...

Windows PowerShell
PS C:\Users\danie\OneDrive\DanxC-Notebook-1\Documentos\Academics\ITA\8º Sem (4º COMP)\CSC-27 (Distributed Computing)\Go Labs and Activities\Lab 2\Process> .\Process.exe 3 :10002 :10003 :10004

+-----+
| RELEASED |
+-----+
Received 'request' from process 1 with clock 1 | Current clock: 2
Sending immediate reply to process 1
Received 'request' from process 2 with clock 5 | Current clock: 6
Sending immediate reply to process 2
```