

Dominando Estruturas de Dados 1

Filas

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Fila

Lista linear em que **o primeiro a entrar é o primeiro a sair da fila.**



Fila

Lista linear em que **o primeiro a entrar é o primeiro a sair da fila.**

Política de gerenciamento de elementos:

FIFO: First In First Out



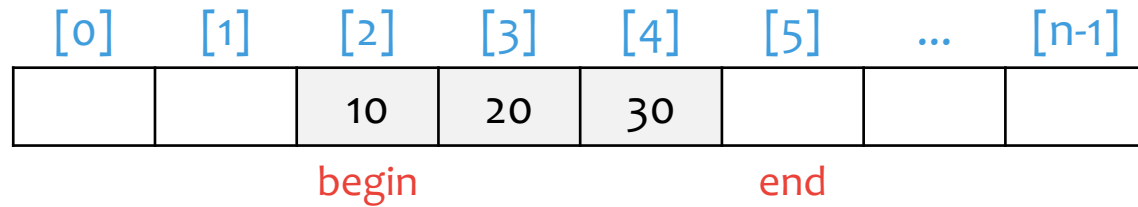
Aplicações

- Serviços de requisições em um único recurso compartilhado:
 - Escalonamento de tarefas de Sistemas Operacionais;
 - Impressões;
 - Atendimento de call center;
 - etc
- Alguns algoritmos de grafos: ex. Breadth First Search, path-finding algorithms

Tipos de Filas

Estáticas

- Implementadas com **vetores**



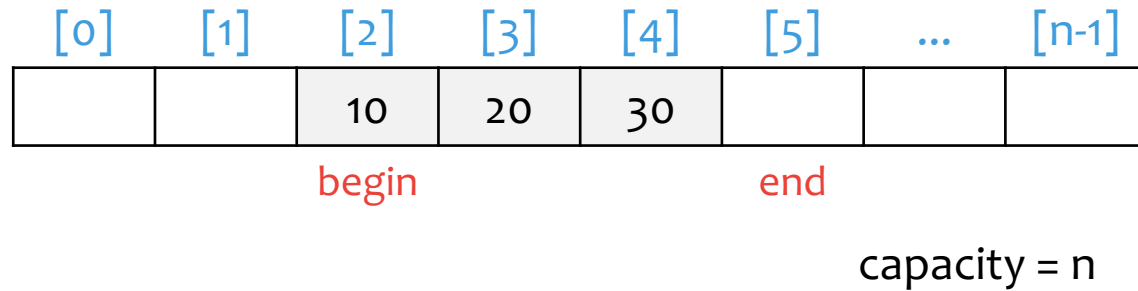
capacity = n

O vetor $Q[\text{begin} .. \text{end}-1]$ armazena uma fila.

Tipos de Filas

Estáticas

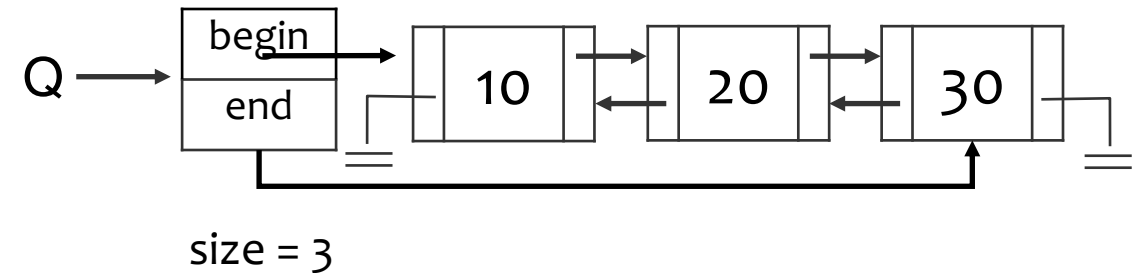
- Implementadas com **vetores**



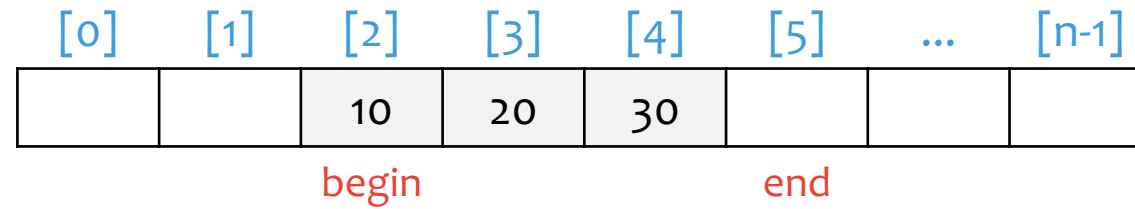
O vetor $Q[\text{begin} .. \text{end}-1]$ armazena uma fila.

Dinâmicas

- Implementadas com **listas encadeadas**



Filas Estáticas

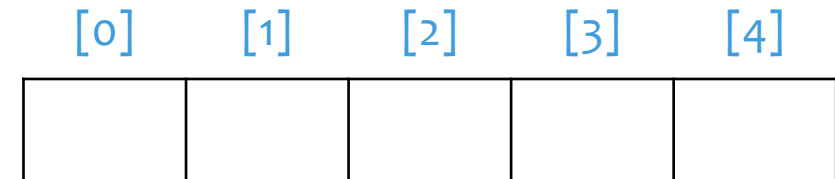


capacity = n

O vetor $Q[\text{begin} .. \text{end}-1]$ armazena uma fila.

Exemplo

```
enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
```



begin
end

capacity = n = 5

A fila está **vazia!**

- **Enfileirar** (**enqueue**) um elemento y:
 - $Q[\text{end}++] = y$;
- **Desenfileirar** (**dequeue**) um elemento da fila:
 - $x = Q[\text{begin}++]$;

Exemplo

enqueue(10)

enqueue(20)

enqueue(30)

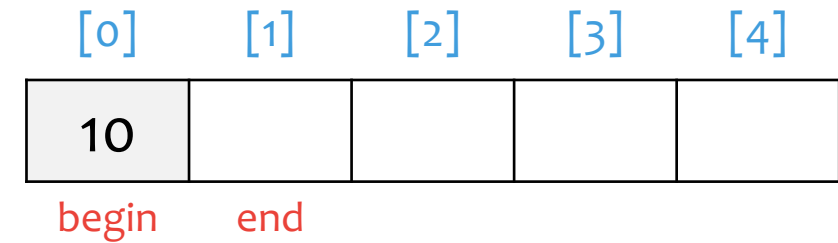
dequeue

enqueue(40)

enqueue(50)

dequeue

enqueue(100)

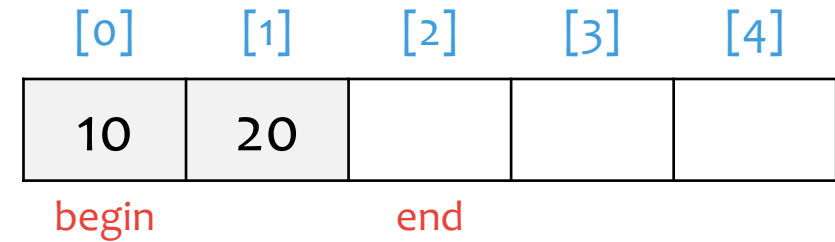


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enqueue(40)
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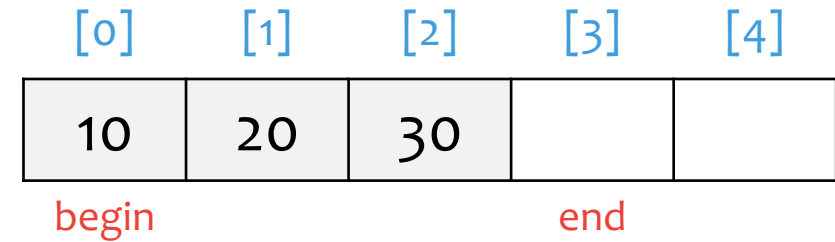


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Exemplo

enqueue(10)

enqueue(20)

enqueue(30)

dequeue

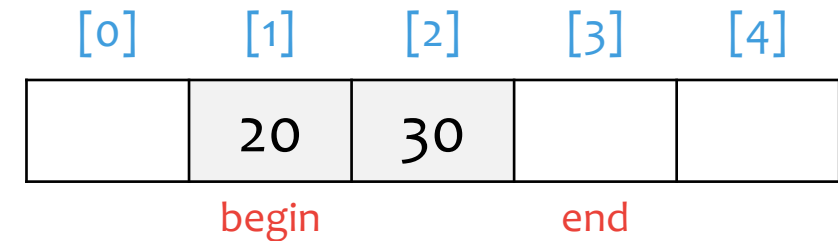
enqueue(40)

enqueue(50)

dequeue

enqueue(100)

10

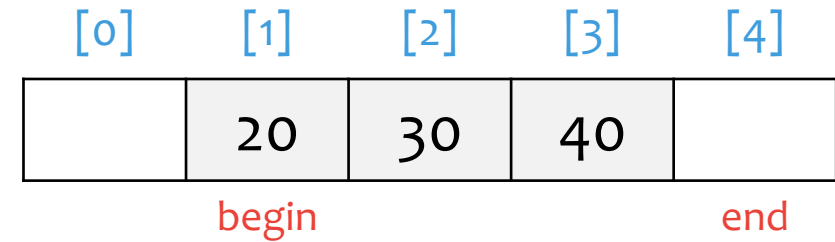


capacity = n = 5

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 - $Q[\text{end}++] = y$;
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Exemplo

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enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)

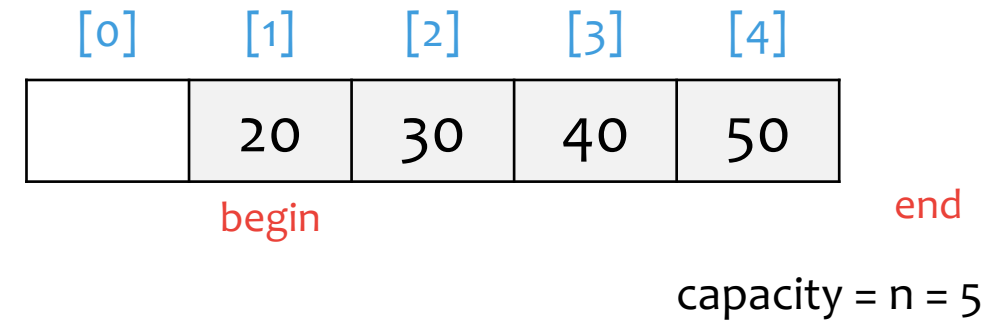


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Exemplo

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enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)

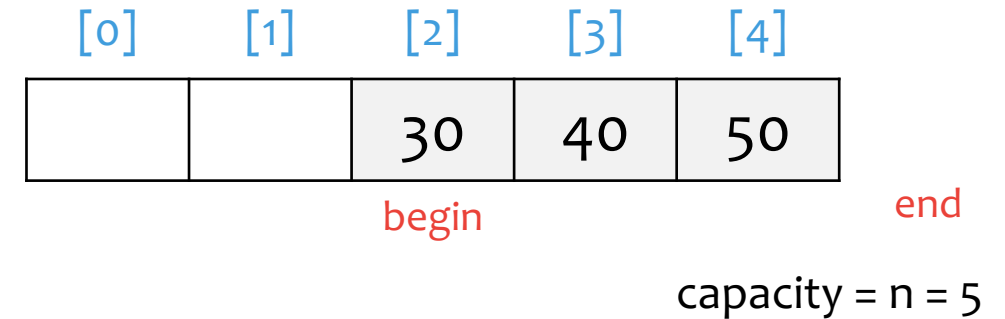


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 - $x = Q[\text{begin}++]$;

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)

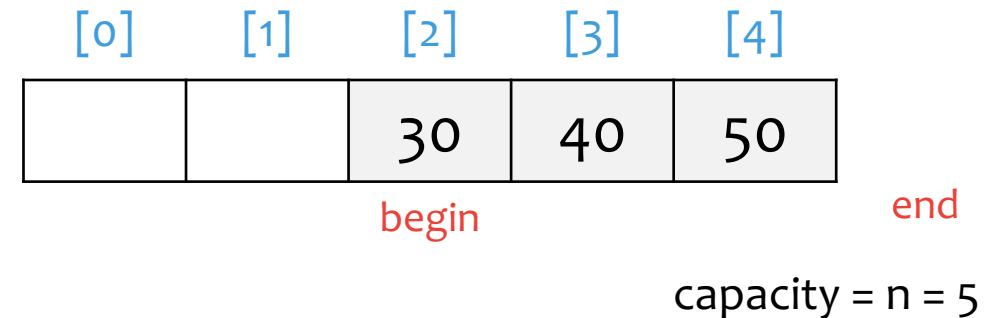
20



- **Enfileirar** (**enqueue**) um elemento y:
 - $Q[\text{end}++] = y$;
- **Desenfileirar** (**dequeue**) um elemento da fila:
 - $x = Q[\text{begin}++]$;

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)



PROBLEMA

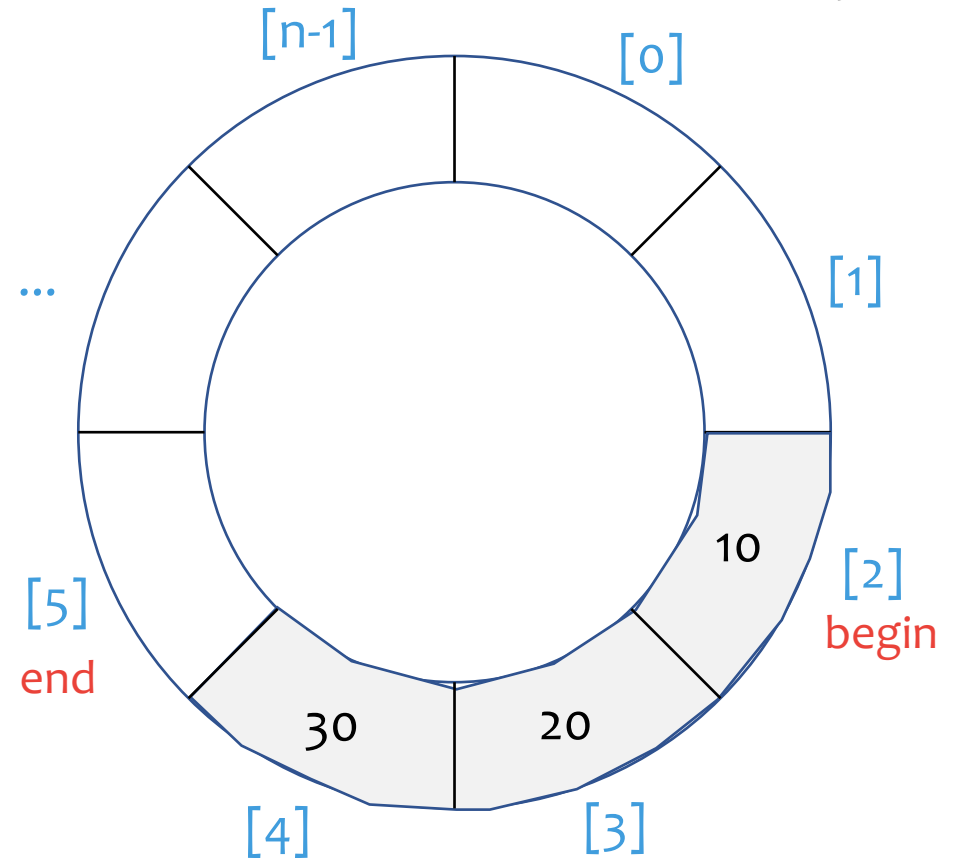
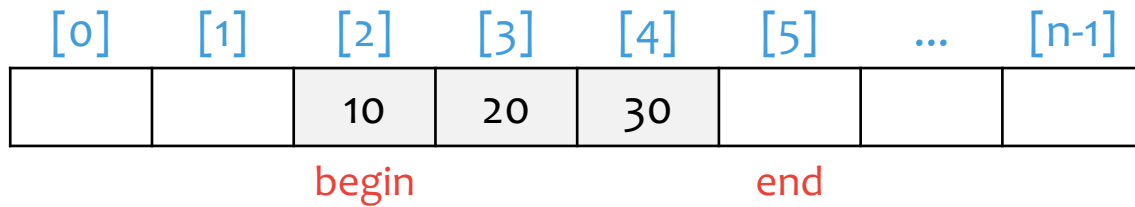
Mesmo tendo **espaços livres**, chegamos
ao final do vetor.

- **Enfileirar** (**enqueue**) um elemento y:
 - $Q[\text{end}++] = y$;
- **Desenfileirar** (**dequeue**) um elemento da fila:
 - $x = Q[\text{begin}++]$;

Filas Circulares Estáticas

capacity = n

size = 3



Filas Circulares Estáticas

Enfileirar (**enqueue**) um elemento y :

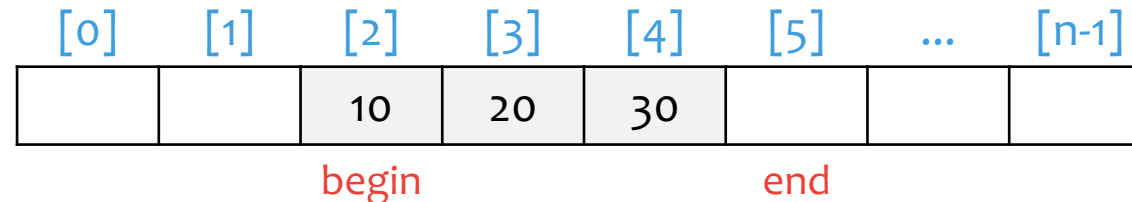
- $Q[\text{end}] = y$;
- $\text{end} = (\text{end} + 1) \% \text{capacity}$;

Consultar (**peek**) um elemento da fila sem removê-lo:

- $x = Q[\text{begin}]$;

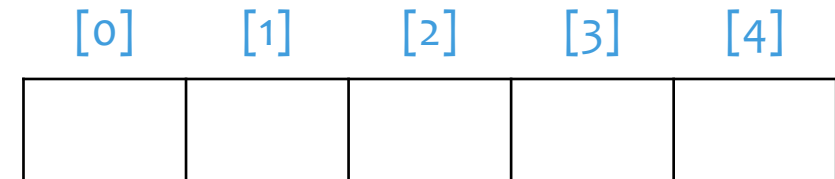
Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}]$;
- $\text{begin} = (\text{begin} + 1) \% \text{capacity}$;



Exemplo

```
enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
enqueue(200)
```



begin
end

capacity = n = 5

A fila está **vazia!**

size = 0

Enfileirar (**enqueue**) um elemento y:

- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

Exemplo

enqueue(10)

enqueue(20)

enqueue(30)

dequeue

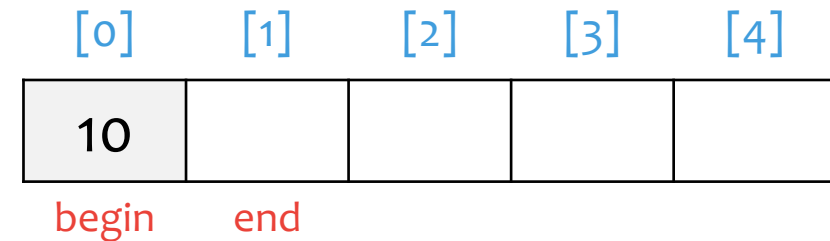
enqueue(40)

enqueue(50)

dequeue

enqueue(100)

enqueue(200)



capacity = n = 5

$Q[0] = 10;$

size = 1

$end = (0 + 1) \% 5 = 1$

Enfileirar (enqueue) um elemento y:

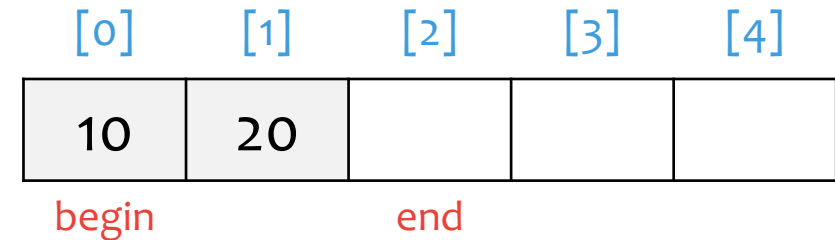
- $Q[end] = y;$
- $end = (end + 1) \% capacity;$

Desenfileirar (dequeue) um elemento da fila:

- $x = Q[begin];$
- $begin = (begin + 1) \% capacity;$

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
enqueue(200)



capacity = n = 5

$Q[1] = 20;$

size = 2

$\text{end} = (1 + 1) \% 5 = 2$

Enfileirar (**enqueue**) um elemento y:

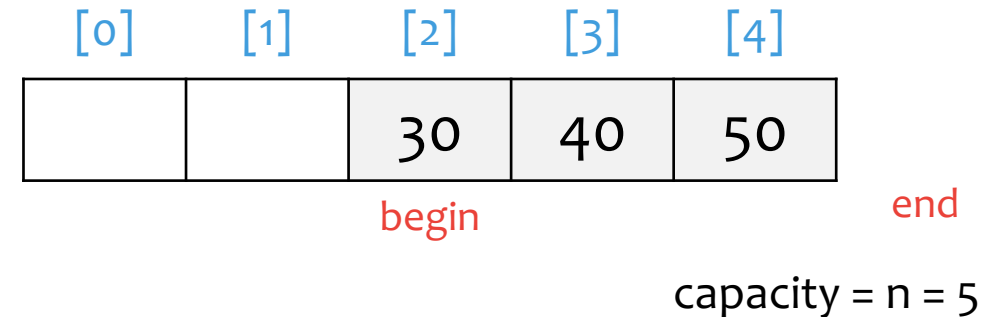
- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)



PROBLEMA

Mesmo tendo **espaços livres**, chegamos
ao final do vetor.

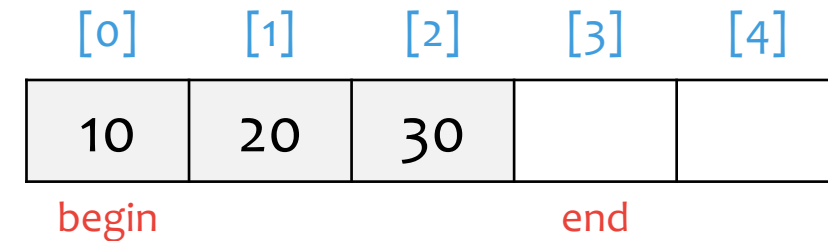
SOLUÇÃO

Fila Circular Estática

- **Enfileirar** (**enqueue**) um elemento y:
 - $Q[\text{end}++] = y$;
- **Desenfileirar** (**dequeue**) um elemento da fila:
 - $x = Q[\text{begin}++]$;

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
enqueue(200)



capacity = n = 5

size = 3

$Q[2] = 30;$

end = $(2 + 1) \% 5 = 3$

Enfileirar (**enqueue**) um elemento y:

- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

Exemplo

enqueue(10)

enqueue(20)

enqueue(30)

dequeue

enqueue(40)

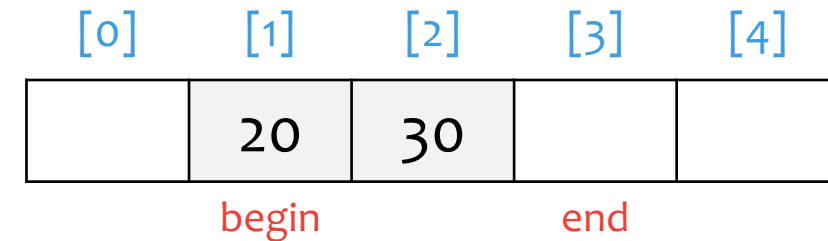
enqueue(50)

dequeue

enqueue(100)

enqueue(200)

10



capacity = n = 5

x = Q[0];

size = 2

begin = (0 + 1) % 5 = 1

Enfileirar (**enqueue**) um elemento y:

- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

enqueue(10)

enqueue(30)

dequeue

enqueue(40)

enqueue(50)

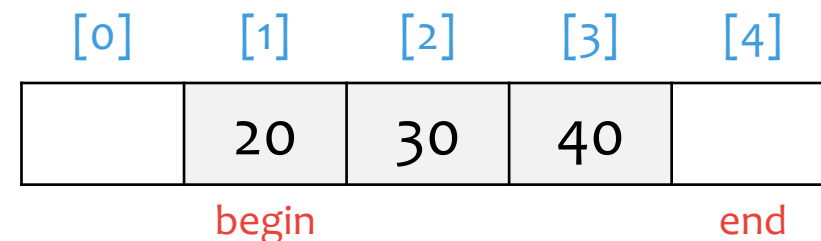
dequeue

```
enqueue(100)
```

enqueue(200)

- $Q[\text{end}] = y$;
- $\text{end} = (\text{end} + 1) \% \text{capacity}$;

- `x = Q[begin];`
- `begin = (begin + 1) % capacity;`



capacity = n = 5

size = 3

Q[3] = 40;

$$\text{end} = (3 + 1) \% 5 = 4$$

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
enqueue(200)

[0]	[1]	[2]	[3]	[4]
	20	30	40	50
end	begin			

capacity = n = 5

size = 4

$Q[4] = 50;$

end = $(4 + 1) \% 5 = 0$

Enfileirar (**enqueue**) um elemento y:

- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

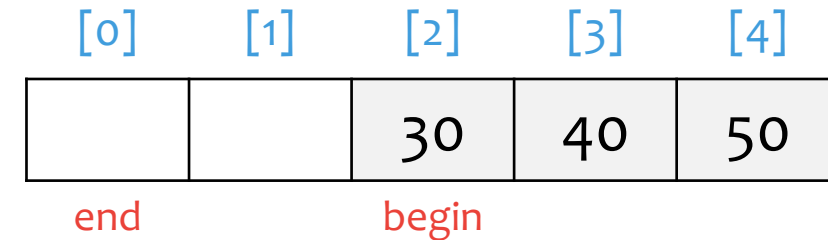
Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
enqueue(200)

20



capacity = n = 5

size = 3

x = Q[1];

begin = (1 + 1) % 5 = 2

Enfileirar (**enqueue**) um elemento y:

- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
enqueue(200)

[0]	[1]	[2]	[3]	[4]
100		30	40	50
end		begin		

capacity = n = 5

$Q[0] = 100;$

size = 4

end = $(0 + 1) \% 5 = 1$

Enfileirar (**enqueue**) um elemento y:

- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

Desenfileirar (**dequeue**) um elemento da fila:

- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

Exemplo

enqueue(10)
enqueue(20)
enqueue(30)
dequeue
enqueue(40)
enqueue(50)
dequeue
enqueue(100)
enqueue(200)

[0]	[1]	[2]	[3]	[4]
100	200	30	40	50

begin
end

capacity = n = 5

size = 5

$Q[1] = 200;$

end = $(1 + 1) \% 5 = 2$

A fila está **cheia!**

Enfileirar (**enqueue**) um elemento y:

- $Q[\text{end}] = y;$
- $\text{end} = (\text{end} + 1) \% \text{capacity};$

Desenfileirar (**dequeue**) um elemento da fila:

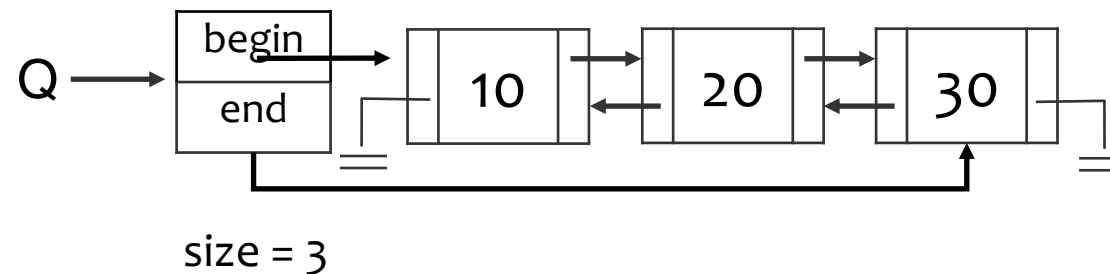
- $x = Q[\text{begin}];$
- $\text{begin} = (\text{begin} + 1) \% \text{capacity};$

Codificando: TAD Fila Circular Estática

- create
- destroy
- is_empty
- is_full
- enqueue
- dequeue
- peek

Filas Dinâmicas

- **Enfileirar** (**enqueue**) um elemento y:
 - Adicionar um nó com o elemento y no **final da lista**
- **Consultar** (**peek**) um elemento da fila sem desempilhá-lo:
 - Retornar o **valor** do nó **inicial da lista**
- **Desenfileirar** (**dequeue**) um elemento da fila:
 - Remover o nó **inicial da lista** retornando seu valor



Codificando: TAD Fila Dinâmica

- create
- destroy
- is_empty
- enqueue
- dequeue
- peek

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