2.1 Knuth Shuffle Demo

click to begin demo
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Playing cards](image-url)
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Diagram of Knuth shuffle with cards and indices]

not yet seen
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$.
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$.
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Shuffle example](image)
Knuth shuffle

• In iteration $i$, pick integer $r$ between $0$ and $i$ uniformly at random.
• Swap $a[i]$ and $a[r]$. 

![Card images showing the knuth shuffle process](image-url)
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Diagram showing the Knuth shuffle process with cards and indices.]
• In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
• Swap $a[i]$ and $a[r]$.
Knuth shuffle

• In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
• Swap $a[i]$ and $a[r]$. 
In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.

Swap $a[i]$ and $a[r]$. 

**Knuth shuffle**

- Cards shuffled
- Cards not yet seen
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$.
In iteration \(i\), pick integer \(r\) between 0 and \(i\) uniformly at random.

Swap \(a[i]\) and \(a[r]\).
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Shuffling cards](image)
Knuth shuffle

- In iteration \(i\), pick integer \(r\) between 0 and \(i\) uniformly at random.
- Swap \(a[i]\) and \(a[r]\).
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$.  

![Diagram of Knuth shuffle](image)
• In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
• Swap $a[i]$ and $a[r]$.
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$.
Knuth shuffle

• In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
• Swap $a[i]$ and $a[r]$.
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$.
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$.
In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
Swapping $a[i]$ and $a[r]$. 

**Knuth shuffle**

[Diagram of playing cards showing the process of a Knuth shuffle, with cards shuffled and not yet seen indicated.]
Knuth shuffle

• In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
• Swap $a[i]$ and $a[r]$.
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Shuffled cards and not-yet-seen cards](image-url)
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Card的形象](image)
In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
Swap $a[i]$ and $a[r]$. 

Knuth shuffle
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 
Knuth shuffle

- In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
- Swap $a[i]$ and $a[r]$. 

![Shuffled cards](image)
Knuth shuffle

• In iteration $i$, pick integer $r$ between 0 and $i$ uniformly at random.
• Swap $a[i]$ and $a[r]$. 