The Somewhat Simplified Solitaire Algorithm

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ACM SIGCSE Nifty Assignments Panel
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Who Is This Guy?

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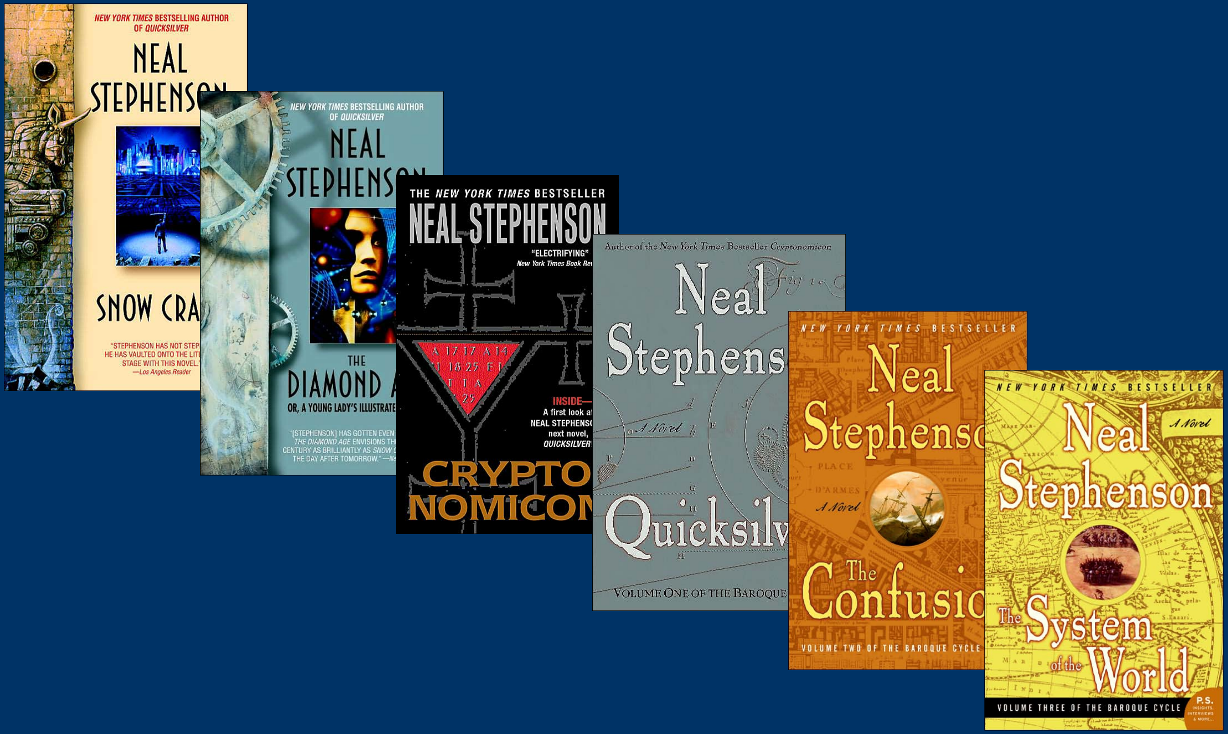
Best-selling Author Neal Stephenson

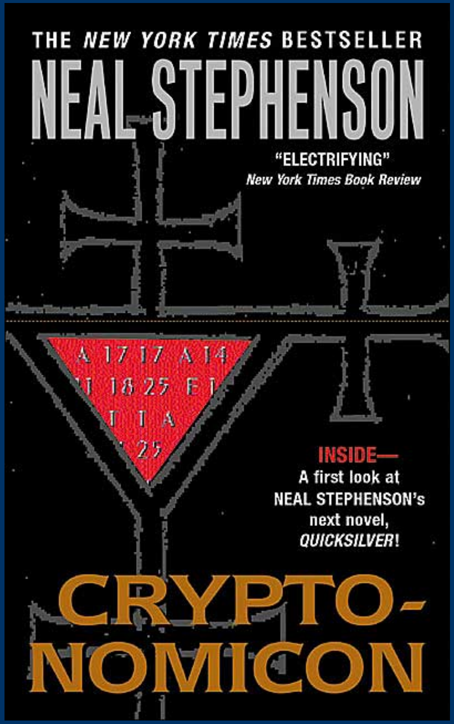
`http://www.nealstephenson.com`

What Has He Written?



(among others)

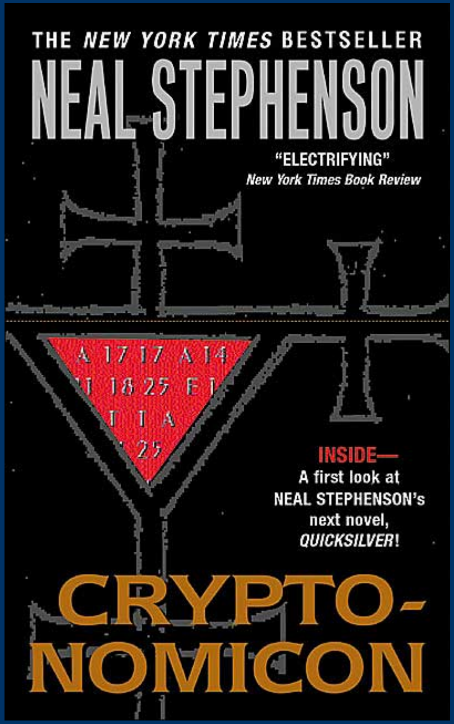
Cryptonomicon



(c) 1999

- A Combination of Historical & Modern-Day Fiction

Cryptonomicon



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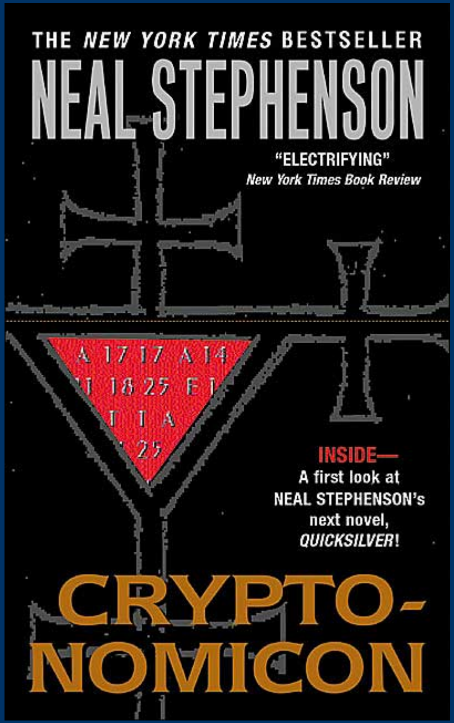

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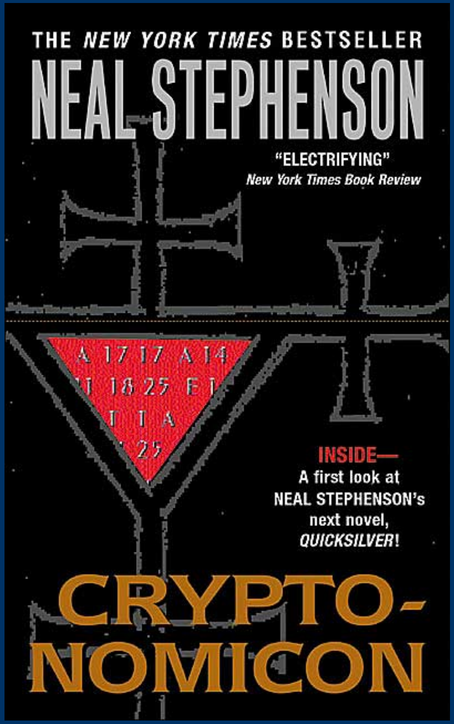
- And After ~ 800 pages . . .

Cryptonomicon



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- A Combination of Historical & Modern-Day Fiction
- Threads Joined By Cryptography
- And After ~ 800 pages . . .
- . . . The Pontifex Transform Is Used

Pontifex == Solitaire

www.schneier.com

- In reality, Pontifex is really security expert Bruce Schneier's Solitaire cryptosystem.
- Schneier describes it in Cryptonomicon's appendix

Solitaire? A *Cryptosystem*??

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AisleRiot: Klondike

Stock left: 3 Redeals left: 2

Score: 8 Time: 00:02:19

No, not *that* Solitaire . . .

Bruce Schneier’s Solitaire

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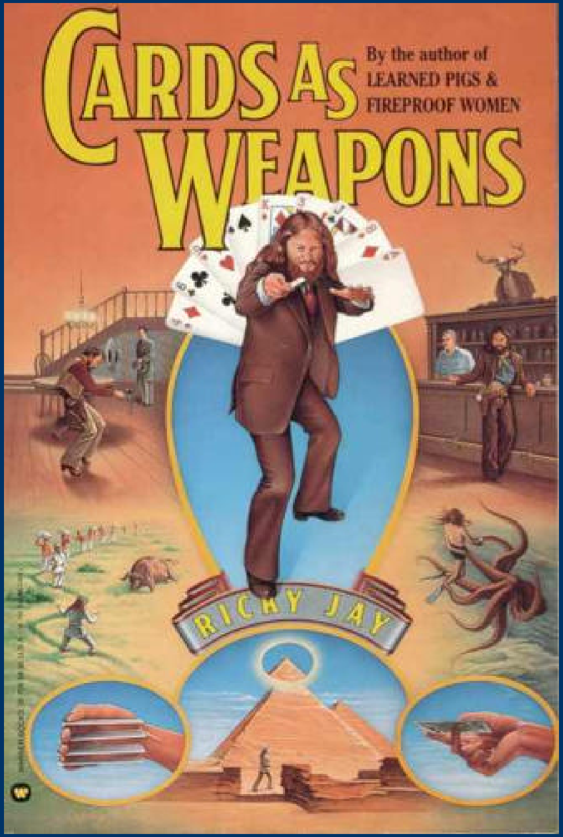
  - Who would question an ordinary deck of cards?

As Tested on MythBusters!



by Ricky Jay, (c) 1977

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Bruce Schneier’s Solitaire

- So named because it is based on manipulations of playing cards
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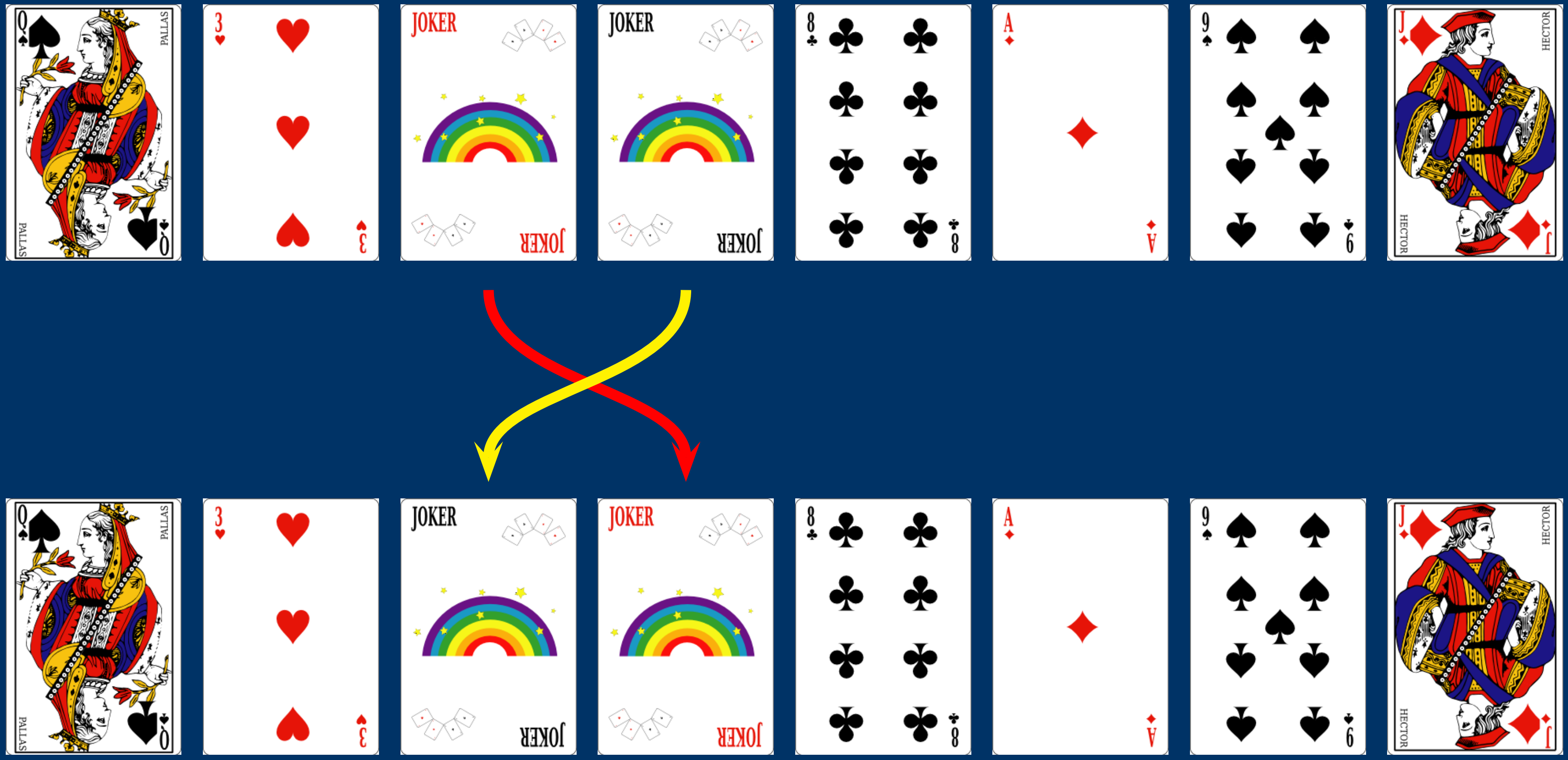
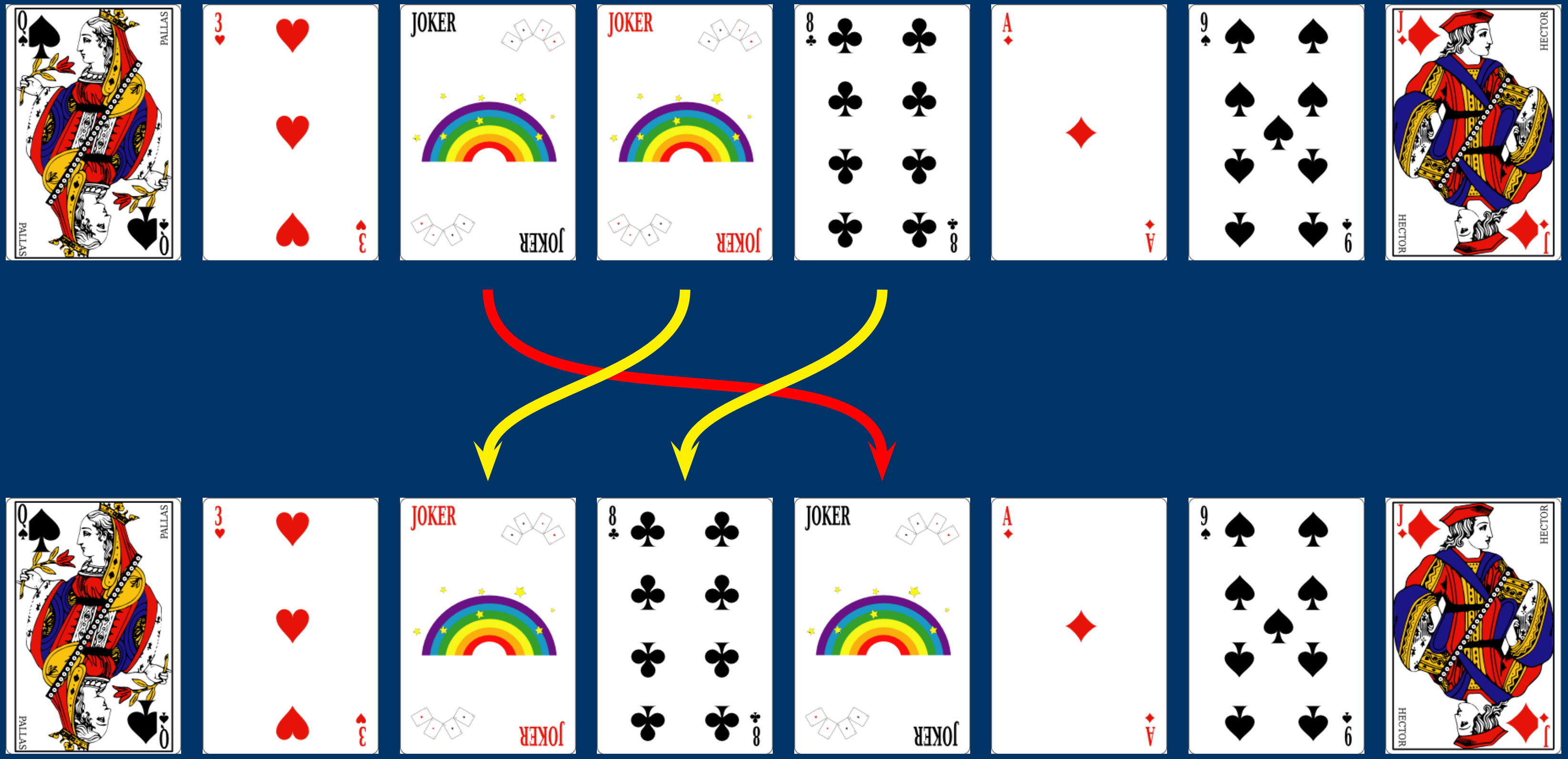
    . . . OK, we’ll ignore that.
- Sender and Receiver begin with matched decks
- Each application of Solitaire generates a sequence of keystream values in the range $[1..26]$
- Roughly:
  - Plaintext + keystream = Ciphertext
  - Ciphertext - keystream = Plaintext

Keystream Algorithm: Step 1 of 5



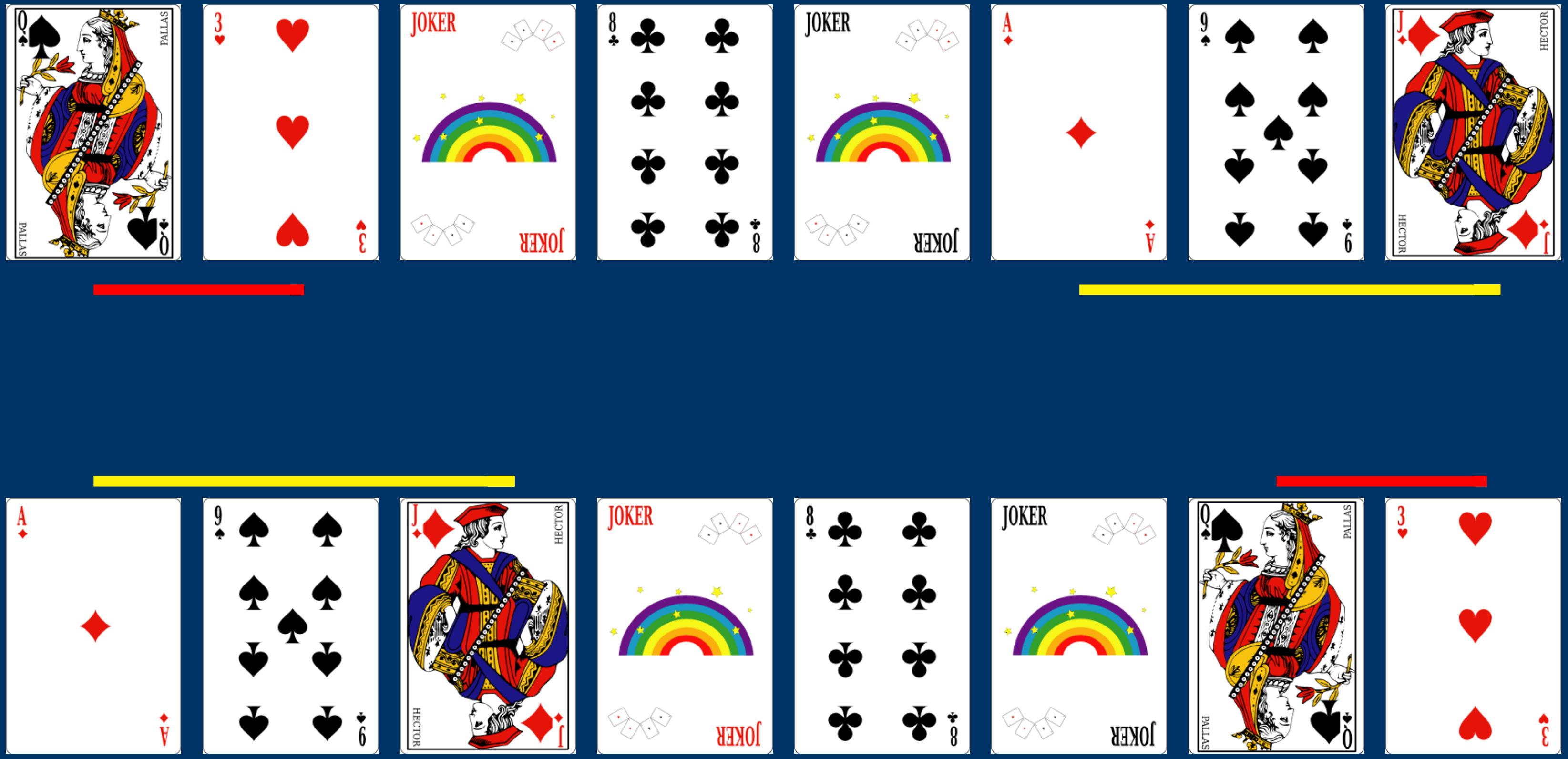
Step 1: Exchange ‘A’ Joker with Following Card

Keystream Algorithm: Step 2 of 5



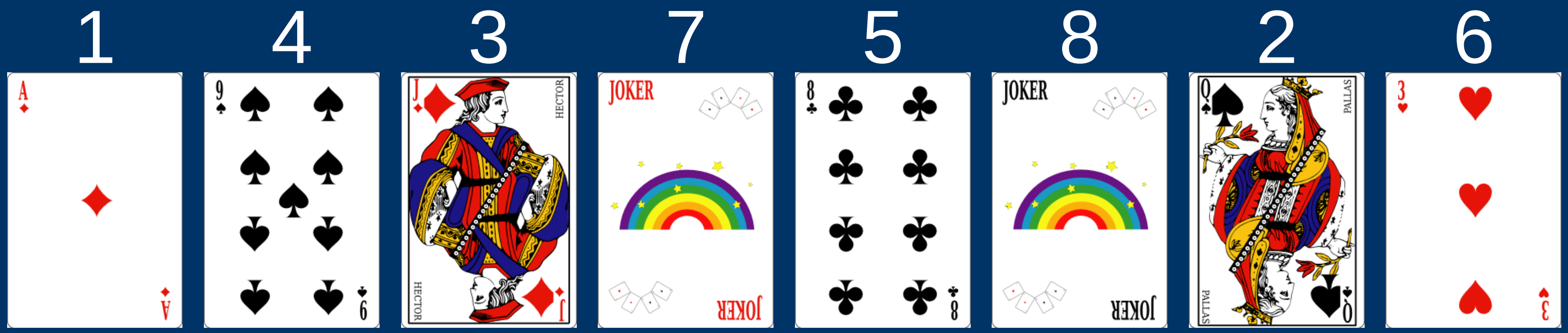
Step 2: Exchange ‘B’ Joker with Following Two Cards

Keystream Algorithm: Step 3 of 5

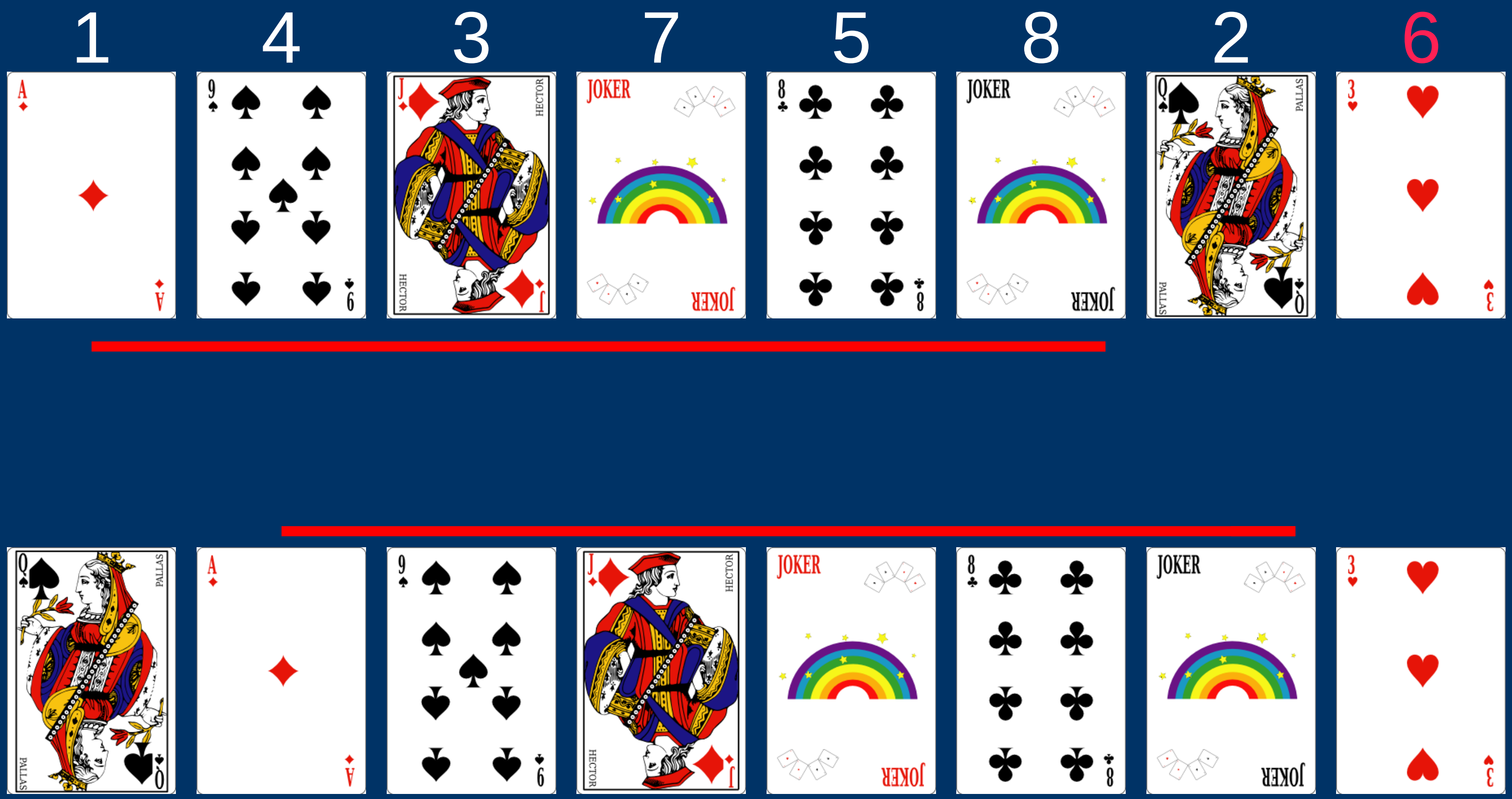


Step 3: “Triple Cut”

Keystream Algorithm: Step 4 of 5

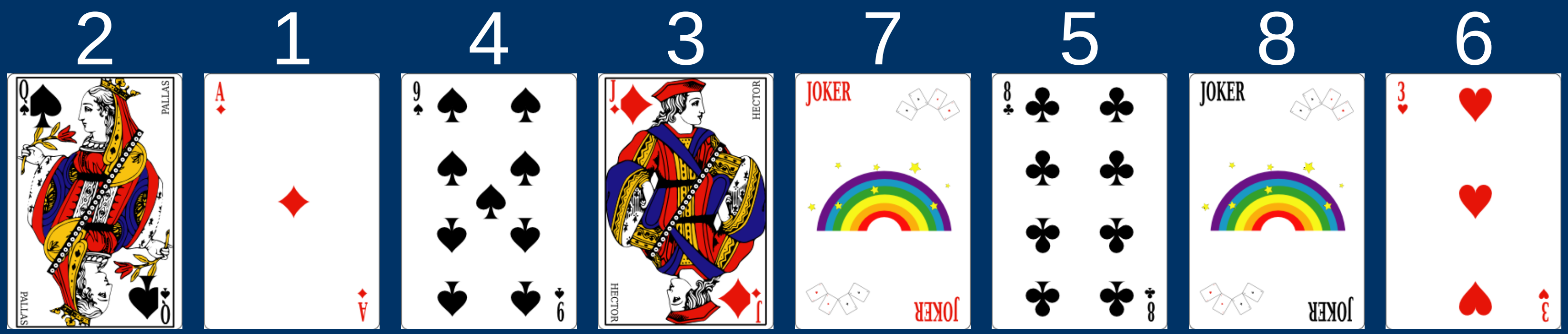


Keystream Algorithm: Step 4 of 5



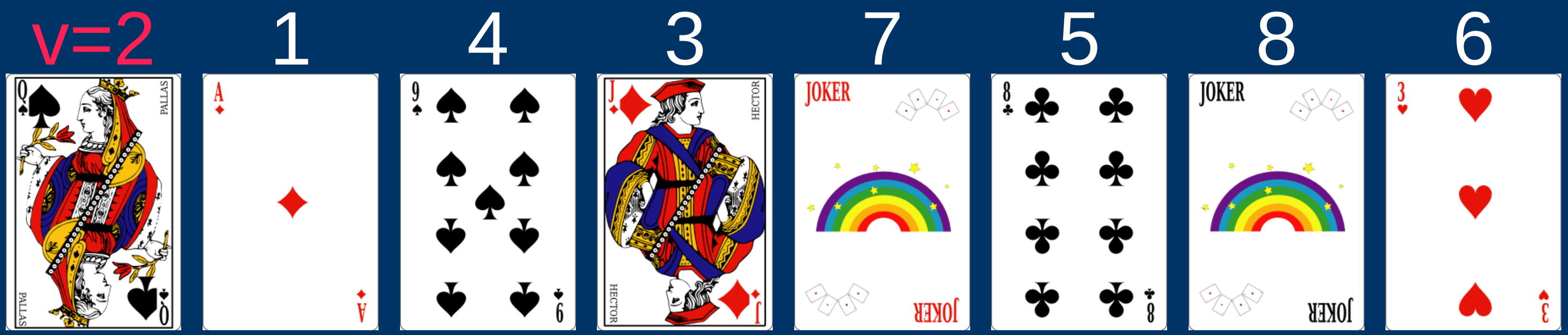
Step 4: Needs More Words Than I Have Space!

Keystream Algorithm: Step 5 of 5



Step 5:

Keystream Algorithm: Step 5 of 5



v=2 1 4 3 7 5 8 6

Step 5: 1st Card’s Value

Keystream Algorithm: Step 5 of 5

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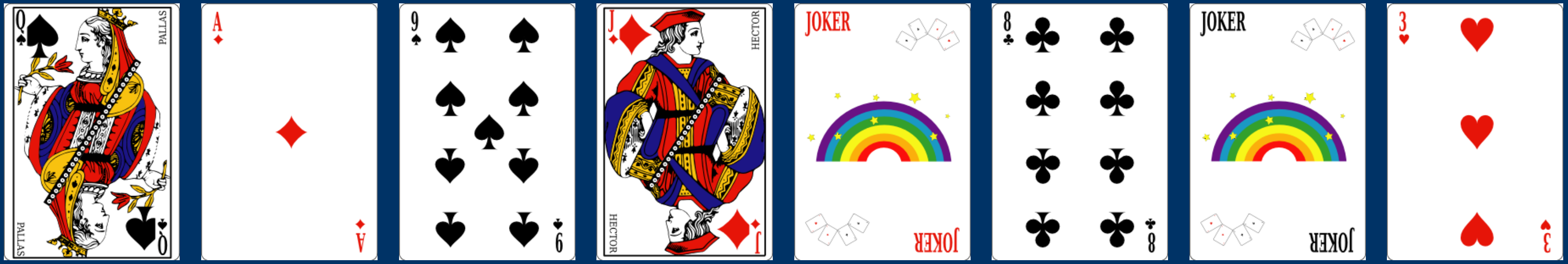
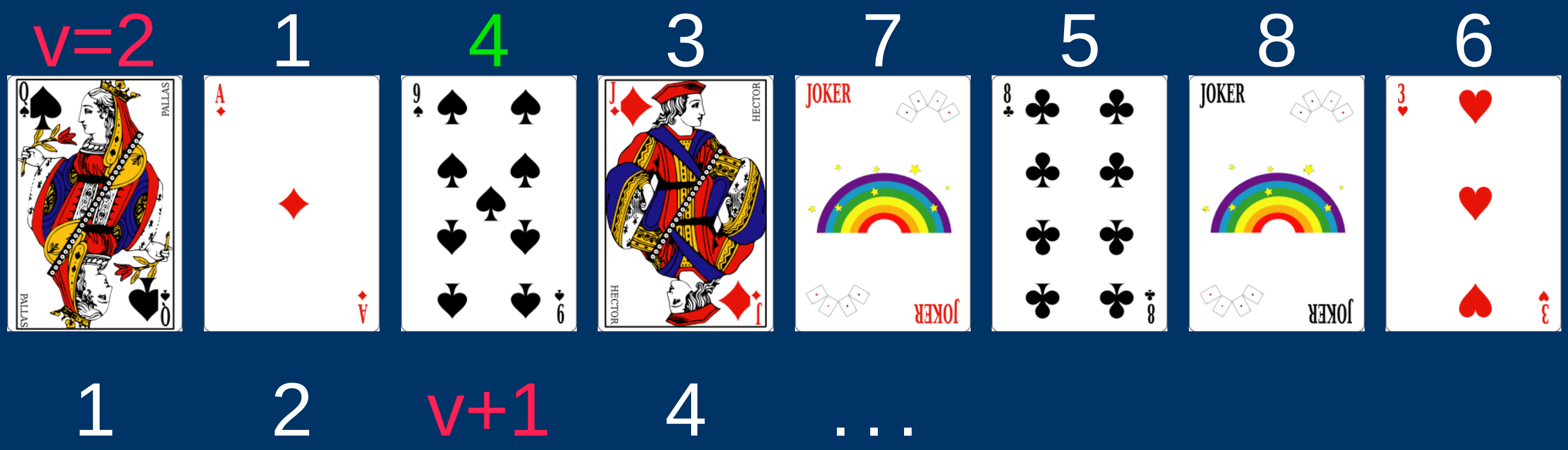


1 2 v+1 4 . . .

Step 5: 1st Card’s Value + 1 ⇒ Index

Keystream Algorithm: Step 5 of 5



v=2 1 4 3 7 5 8 6

1 2 v+1 4 . . .

Step 5: 1st Card’s Value + 1 ⇒ Index ⇒ Keystream Value = 4

Encryption

Plaintext:	N	I	F	T	Y
	⇓	⇓	⇓	⇓	⇓
Letter Values:	14	9	6	20	25
Keystream Sequence:	4	2	4	1	5
Sums:	18	11	10	21	30
Wrap:	18	11	10	21	4
	⇓	⇓	⇓	⇓	⇓
Ciphertext:	R	K	J	T	D

Decryption

Ciphertext:	R	K	J	T	D
	⇓	⇓	⇓	⇓	⇓
Letter Values:	18	11	10	21	4
Keystream Sequence:	4	2	4	1	5
Differences:	14	9	6	20	-1
Wrap:	14	9	6	20	25
	⇓	⇓	⇓	⇓	⇓
Plaintext:	N	I	F	T	Y

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⇒ Unwise cryptographically . . . but so what?

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∴ Applicable to CS0, CS1, CS2, and even CS7.

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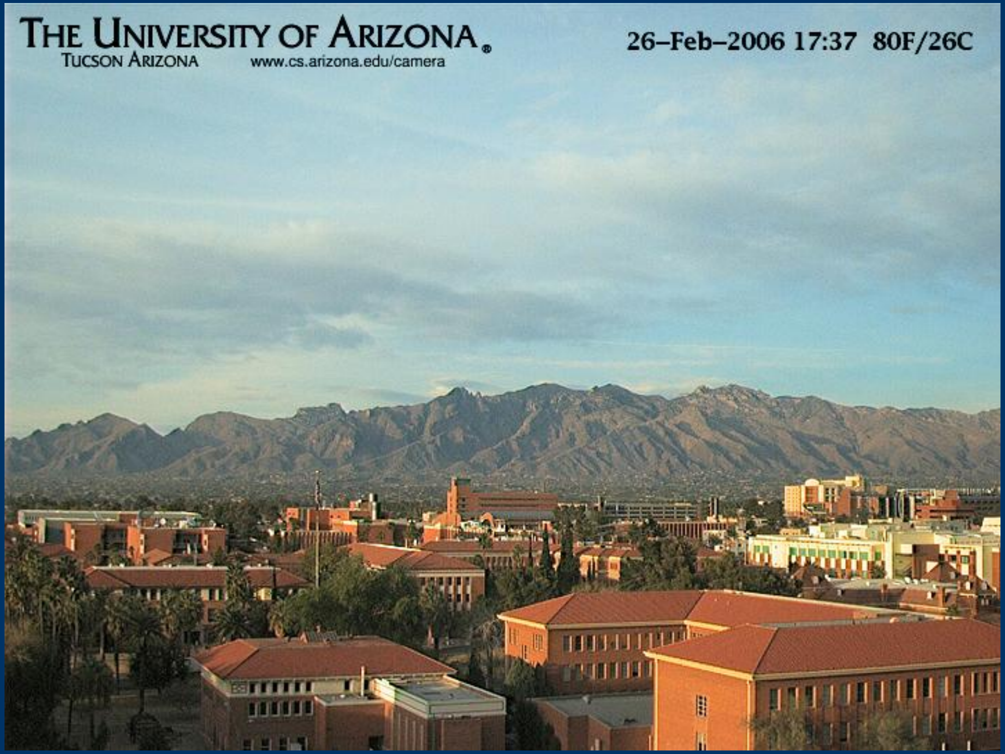
- Just *might* encourage students to read a novel! ☺

Image Credits

- Neal Stephenson: Bela Bollobas
- Bruce Schneier: dk.compulenta.ru
- Stephenson book covers: barnesandnoble.com
- Klondike: AisleRot 2.10.0 / Jonathan Blandford
- Cards As Weapons: amazon.com
- Card Images: david.bellot.free.fr
- UA Campus: The UA Computer Science Webcam

Any Questions?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