

Line: **Diplom-IT**  
 Course: **02321 HW/SW Programming**  
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 Date of completion: **January 2013**  
 Project name: **Card Trick 27**

# Card Trick 27

**Algorithmic coupling: By implementing two independently running algorithms Card Trick 27 can identify and place any card anywhere in a deck of 27 cards.**



Non-digitized play-through of the card trick:  
 Requirements:

- One benevolent trickster
- One willing participant
- A deck of 27 unique cards drawn from a standard 52 card deck

Steps:

1. The participant chooses a number between 1 and 27.
2. The deck is presented face down to the participant.
3. A single card is drawn and identified by the participant before being returned to the deck without revealing it.
4. The deck is dealt into three face-up piles from which the participant identifies the pile containing their card.
5. The trickster gathers the piles back into a single deck. -- Steps 4. and 5. are repeated twice more --
6. After the final gathering of the piles the trickster counts off cards from the top of the deck face down until he reaches the number chosen at the beginning. That card is revealed and will by a mathematical miracle be the very same card picked by the amazed participant!

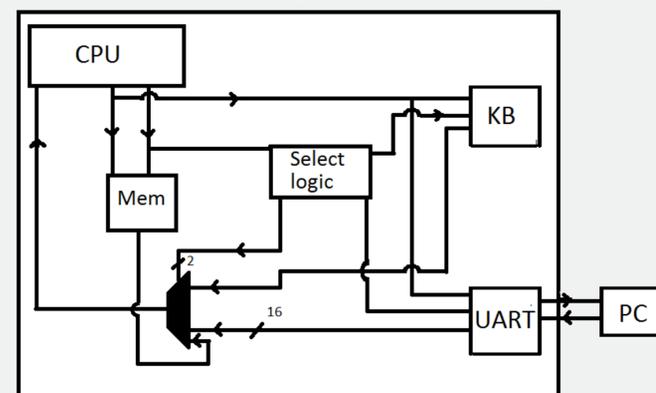
The digital version:

Hardware:

A Nexus 3 FPGA provided by the course serves as the hardware platform for the project. Upon this board we have configured the following elements:

- Memory
- Address Control Logic
- Keyboard
- Universal asynchronous receiver/transmitter

These function in harmony with the existing CPU.



Digital representation:

The program interface is text-only and uses the ASCII table to show card sets like so: ♠♦♥♣

Software:

The C-code implementation queries the user for input as needed while dealing and gathering the deck to and from piles. This accurately represents the algorithmic search for the unknown card as well as the positioning within the deck of that same card.

Shoutouts:

We thank the cast and crew of the course for facilitating a fun and challenging CDIO project!

```
Starting processing c:\lc3\bin\lc3terminal.ini
Processing parameters from: "c:\lc3\bin\lc3terminal.ini"
Checking the Variables

Parameters used by the program:
*****
Serial Port:COM5
Baud Rate:115200
Parity:None
Program is executed after upload
Program is uploaded in chunks of 128 bytes
The program will be retransmitted up to 10 times in case of transmission errors
The uploaded data will be validated
*****
Serial port COM5 successfully configured.
Querying device...
Uploading "main.obj":
5147 words starting from x0500
100% complete -- 10294 of 10294 bytes verified

No errors found in final transmission of "main.obj"
Starting uploaded program (at: x0500).Console started.

Jumping to user code.
Card Trick Machine by Steen & Kasper.
<<< READY PLAYER ONE >>>

Game 1
Type a integer between 1 and 27.
*****
Input number 19
*****
File 1 File 2 File 3
w1 w2 w3
w4 w5 w6
w7 w8 w9
+1 +2 +3
+4 +5 +6
+7 +8 +9
+1 +2 +3
+4 +5 +6
+7 +8 +9
Type the pile number that contains your card (1, 2 or 3)
*****
Chosen pile: 2
*****
File 1 File 2 File 3
w2 w5 w8
w2 +5 +8
w1 w4 w7
+1 +4 +7
+2 +5 +8
+3 +6 +9
+3 +6 +9
Type the pile number that contains your card (1, 2 or 3)
*****
Chosen pile: 2
*****
File 1 File 2 File 3
w5 +5 +5
w4 +4 +4
w6 +6 +6
w2 +2 +2
w1 +1 +1
w3 +3 +3
w8 +8 +8
w7 +7 +7
*****
Chosen pile: 1
*****
Top of deck -- numerical placements of cards in the deck -- Bottom of deck
*****
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
*****
+5 +4 +6 +2 +1 +3 +8 +7 +9 +5 +4 +6 +2 +1 +3 +8 +7 +9 +5 +4 +6 +2 +1 +3 +8 +7 +9
*****
Corresponding card values to the numerical placements of the cards in the deck
*****
Your input number was 19 and your card should be displayed beneath it.
Thank you for playing!
<<< Press 1 to play again >>>
```