



Main Challenge

de Bruijn Sequences

✓ 3) de Bruijn Sequences

Difficulty: 🌲🌲🌲🌲🌲

When you break into the speaker unpreparedness room, what does Morcel Nougat say? *For hints on achieving this objective, please visit Tangle Coalbox and help him with **Lethal ForensicELFication** Cranberry Pi terminal challenge.*



Hint Challenge

Lethal ForensicELFication

Cranberry Pi terminal challenge



Hint Challenge Lethal ForensicELFication

Cranberry Pi terminal challenge

📍 Tangle Coalbox at 2nd floor go right in the corridor at Speaker Unpreparedness Room.

Hi, I'm Tangle Coalbox.

Any chance you can help me with an investigation?

Elf Resources assigned me to look into a case, but it seems to require digital forensic skills.

Do you know anything about Linux terminal editors and digital traces they leave behind?

Apparently editors can leave traces of data behind, but where and how escapes me!



Vim Artifacts > Forensic Relevance of Vim Artifacts

<https://tm4n6.com/2017/11/15/forensic-relevance-of-vim-artifacts/>



Terminal Screen

```
... ..:c::ccoooodxkk00k000KKXXXNNWMMMMMM
ldd: .d' ' .o: .d; .: 'dl;do,:lloc:coddod00xxk0K0KKXXXNNWMMMMMM
lo.ol.d' ' ' ,d'.lc.: 'docod,:l:locldldd0k0xdxx0K0KKXXXNNWMMMMMM
lo lod' ' ' co:o... 'dl:dl,:l:oodlcddox0kxxk0K0KKXXXNNWMMMMMM
.. ..:c: 'l;c::llccoooodkk000k000KKXXXNNWMMMMMM
.....:ccclloooddxxkk0000KKXXXNNWMMMMMM
.....:ccclloooddxxkk0000KKXXXNNWMMMMMM

Christmas is coming, and so it would seem,
ER (Elf Resources) crushes elves' dreams.
One tells me she was disturbed by a bloke.
He tells me this must be some kind of joke.

Please do your best to determine what's real.
Has this jamoke, for this elf, got some feels?
Lethal forensics ain't my cup of tea;
If YOU can fake it, my hero you'll be.

One more quick note that might help you complete,
Clearing this mess up that's now at your feet.
Certain text editors can leave some clue.
Did our young Romeo leave one for you?

- Tangle Coalbox, ER Investigator

Find the first name of the elf of whom a love poem
was written. Complete this challenge by submitting
that name to runtoanswer.
elf@1df456b45f30:~$
```





Solution

1. First let's try this command from hints link to find any forensic relevance to Vim text-editor:

```
cat .viminfo
```

The `.viminfo` file is a special file used to remember information that would otherwise be lost when exiting vim, you can copy text to notepad for clearer view.

```
elf@c0e2ba88c9ec:~$ cat .viminfo
# This viminfo file was generated by Vim 8.0.
# You may edit it if you're careful!

# Viminfo version
|1,4

# Value of 'encoding' when this file was written
*encoding=utf-8

# hlsearch on (H) or off (h):
~h
# Last Substitute Search Pattern:
~MSle0~&Elinore

# Last Substitute String:
$NEVERMORE

# Command Line History (newest to oldest):
:wq
|2,0,1536607231,,"wq"
:%s/Elinore/NEVERMORE/g
|2,0,1536607217,,"%s/Elinore/NEVERMORE/g"
:r .secrets/her/poem.txt
|2,0,1536607201,,"r .secrets/her/poem.txt"
:q
|2,0,1536606844,,"q"
:w
|2,0,1536606841,,"w"
:s/God/fates/gc
|2,0,1536606833,,"s/God/fates/gc"
```



2. As you can see this all information collected from vim editor, by inspecting the results you will find some clues:

- In Last Substitute Search Pattern there is a name : **Elinore**
- In Command Line History the command **wq** used to save file and exit in :

```
%s/Elinore/NEVERMORE/g
```

```
s/God/fates/gc
```

```
%s/studied/looking/g
```

```
%s/sound/tenor/g
```

- The poem file location **.secrets/her/poem.txt**





3. You can view the poem file using this command :

```
cat .secrets/her/poem.txt
```

```

elf@c0e2ba88c9ec:~$ cat .secrets/her/poem.txt
Once upon a sleigh so weary, Morcel scrubbed the grime so dreary,
Shining many a beautiful sleighbell bearing cheer and sound so pure--
    There he cleaned them, nearly napping, suddenly there came a tapping,
As of someone gently rapping, rapping at the sleigh house door.
"'Tis some caroler," he muttered, "tapping at my sleigh house door--
    Only this and nothing more."

Then, continued with more vigor, came the sound he didn't figure,
Could belong to one so lovely, walking 'bout the North Pole grounds.
    But the truth is, she WAS knocking, 'cause with him she would be talking,
Off with fingers interlocking, strolling out with love newfound?
Gazing into eyes so deeply, caring not who sees their rounds.
    Oh, 'twould make his heart resound!

Hurried, he, to greet the maiden, dropping rag and brush - unladen.
Floating over, more than walking, moving toward the sound still knocking,
    Pausing at the elf-length mirror, checked himself to study clearer,
Fixing hair and looking nearer, what a hunky elf - not shocking!
Peering through the peephole smiling, reaching forward and unlocking:
    NEVERMORE in tinsel stocking!

Greeting her with smile dashing, pearly-white incisors flashing,
Telling jokes to keep her laughing, soaring high upon the tidings,
    Of good fortune fates had borne him. Offered her his dexter forelimb,
Never was his future less dim! Should he now consider gliding--
No - they shouldn't but consider taking flight in sleigh and riding
    Up above the Pole abiding?

Smile, she did, when he suggested that their future surely rested,
Up in flight above their cohort flying high like ne'er before!
    So he harnessed two young reindeer, bold and fresh and bearing no fear.
In they jumped and seated so near, off they flew - broke through the door!
Up and up climbed team and humor, Morcel being so adored,
    By his lovely NEVERMORE!

-Morcel Nougat

```



3. All clues lead to elf named **Elinore** , Let's enter the name into **runtoanswer** :

```

Find the first name of the elf of whom a love poem
was written. Complete this challenge by submitting
that name to runtoanswer.
elf@8b4f3acdf63e:~$ runtoanswer
Loading, please wait.....

Who was the poem written about? Elinore

WWNXXK0000kkxddoollcc:::,,,'''.....
WWNXXK0000kkxddoollcc:::,,,'''.....
WWNXXK0000kkxddoollcc:::,,,'''.....
WWNXXKK0000xddddollccll:::,,,'''.....
WWNXXKKK000kxdxxxollcccoo::,cc,:...:::,,,'''.....
WWNXXKKK000kxdxxxollcccoo::,cc,:...:::,,,'''.....
WWNXXKKK000kxdxxxollcccoo::,cc,:...:::,,,'''.....
WWNXXKK000kxdxxxollcccoo::,cc,:...:::,,,'''.....
WWNXXKKK000kxdxxddooccoo::,cc,:...:::,,,'''.....
WWNXXKK000kkxdddoollcc:::,,,'''.....
WWNXXK0000kkxddoollcc:::,,,'''.....

Thank you for solving this mystery, Slick.
Reading the .viminfo sure did the trick.
Leave it to me; I will handle the rest.
Thank you for giving this challenge your best.

-Tangle Coalbox
-ER Investigator

Congratulations!
```





Hey, thanks for the help with the investigation, gumshoe.

Have you been able to solve the lock with the funny shapes?

It reminds me of something called “**de Bruijn Sequences**.”

You can optimize the guesses because **there is no start and stop -- each new value is added to the end and the first is removed.**

I’ve even seen **de Bruijn sequence generators** online.

Here the length of the **alphabet is 4 (only 4 buttons)** and the length of the PIN is **4 as well.**

Mathematically this is $k=4, n=4$ to generate the de Bruijn sequence.

Math is like your notepad and pencil - can’t leave home without it!

I heard Alabaster lost his badge! That’s pretty bad. What do you think someone could do with that?



Opening a Ford Lock Code

Opening a Ford with a Robot and the de Bruijn Sequence.

<https://hackaday.com/2018/06/18/opening-a-ford-with-a-robot-and-the-de-bruijn-sequence/>



de Bruijn Sequence Generator

<http://www.hakank.org/comb/debruijn.cgi>





Main Challenge

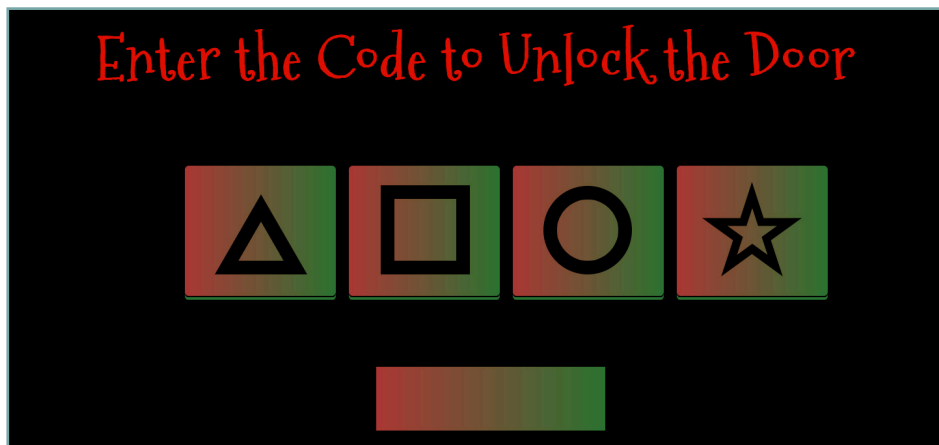
de Bruijn Sequences

📍 Speaker Unpreparedness Room in 2nd floor go right in the hole



Solution

1. Let's take a look at the door:



2. Use provided de Bruijn Sequence online generator to know guesses for the door key :

- Go to : <http://www.hakank.org/comb/debruijn.cgi>
- Enter k: 4 , n: 4 because the length of the PIN is 4 > Click Ok :

New search (restrictions: $1 < n < 15$, $1 < k < 15$, $k^n < 50000$)

k: 4 n: 4

See [below](#) for more info about Bruijn sequences. You may also want try my de Bruijn sequence [Java Applet](#).

de Bruijn sequence, k=4, n=4

The following is a de Bruijn sequence of a $k=4$ sized alphabet with string length of $n=4$. Please note that the sequence is circular, i.e. it wraps "around the (inside parenthesis).

Sequence length: $k^n = 4^4 = 256$ (with the "wrap": $k^n + (n-1) = 4^4 + (4-1) = 259$)

- You can see results under Sequence title

Sequence:

```
00001000200030011001200130021002200230031003200330101020103011101120113012101220123
02220223023102320233030311031203130321032203230331033203331111211131122112311321133
321333222232232323333(000)
```

- Now go to door lock and start with numbers from the sequence beginning until you find the correct pin for the door lock .
- The correct PIN is **0 1 2 0**
- Now enter the room and click on Morcel Nougat to see what he is saying :



Welcome unprepared speaker!



Go to your Badge > Objectives > Enter **Welcome unprepared speaker!**



3) de Bruijn Sequences

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