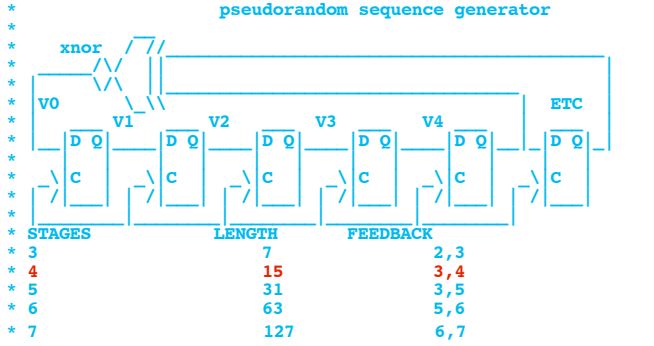
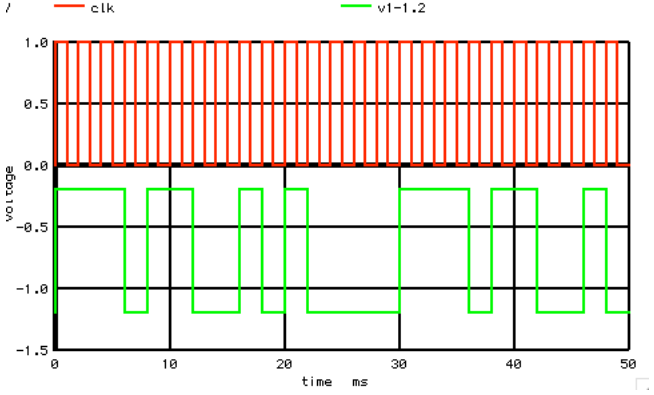
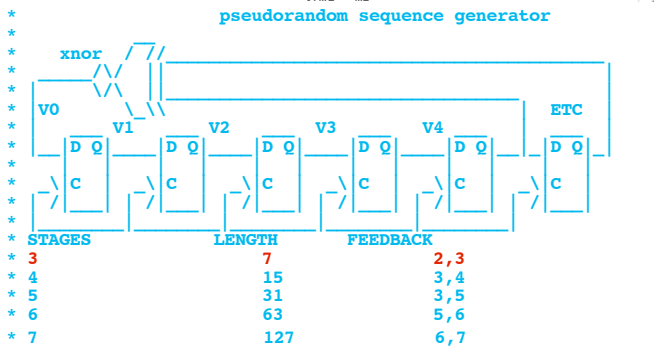
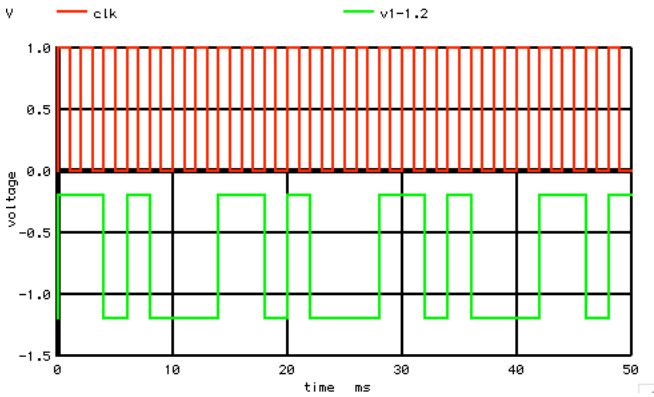


=====Repeatable_Randomness=====

- 1) Pseudorandom sequence generating circuits repeat themselves over time.
- 2) The number of flips flops used defines the length of the randomness.
- 3) Pseudorandomness can modulate a signal to look like noise (spread spectrum modulation).
- 4) Spread spectrum modulated signal can be demodulated back into signal using the same pseudorandom sequence generating circuit.




```
* 6          63          5,6
* 7          127         6,7
```

-----Create Signal-----

```
*.OPTIONS GMIN=1p METHOD=trap ABSTOL=1m TEMP=27 srcsteps = 1 gminsteps = 1
*.OPTIONS RELTOL=.001 ABSTOL=1p VNTOL=1u ITL4=500 ITL1=400
*V_PULSE# NODE_P NODE_N DC VALUE PULSE( VINIT VPULSE TDELAY TRISE TFALL PWIDTH PERIOD )
VCLK CLK 0 DC 0 PULSE( 0 1 1n 1n 1n 1m 2m )
```

```
XDFF1 V0 CLK V1 D_FF
XDFF2 V1 CLK V2 D_FF
XDFF3 V2 CLK V3 D_FF
XDFF4 V3 CLK V4 D_FF
XDFF5 V4 CLK V5 D_FF
XDFF6 V5 CLK V6 D_FF
BA A 0 V = v(V3)
BB B 0 V = v(V2)

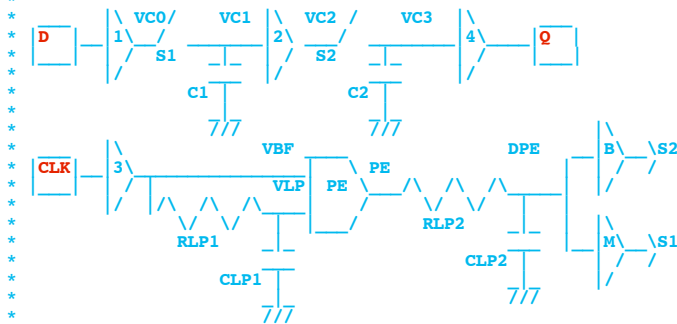
BXNOR V0 0 V = 1-u( v(A)*( .5-v(B) ) + v(B)*( .5-v(A) )-.1)
```

.control

```
set pensize = 2
tran 1u 50m 0 1u
plot clk v1-1.2
.endc
```

-----D_FF-----

```
*
* This subcircuit uses a break before make to converge !!!!
*
```



```
.SUBCKT D_FF D CLK Q
B3 VBF 0 V = u( v(CLK )-.5 )
RLP VBF VLP 1k
CLP VLP 0 5n
BAND VPE 0 V = u( u(v(VBF )-.5)*u(.5 -v(VLP ) ) -.5)
RLP2 VPE VLP2 .3k
CLP2 VLP2 0 2n
BBR BRK 0 V = 1-u(v(VLP2 )-.2)
BMAK MAK 0 V = u(v(VLP2 )-.9)
B1 VC0 0 V = u( v(D )-.5 )
S1 VC0 VC1 MAK 0 SW
C1 VC1 0 10n
R1 VC1 0 10Meg
B2 VC2 0 V = u( v(VC1 )-.5 )
S2 VC2 VC3 BRK 0 SW
C2 VC3 0 1n
R2 VC3 0 10Meg
B4 Q 0 V = u(v(VC3 )-.5)
.ENDS D_FF

.MODEL SW SW( VT=.5 VH=.1 RON=10 ROFF=100MEG)
```

.end

4.4.11_11.03AM
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