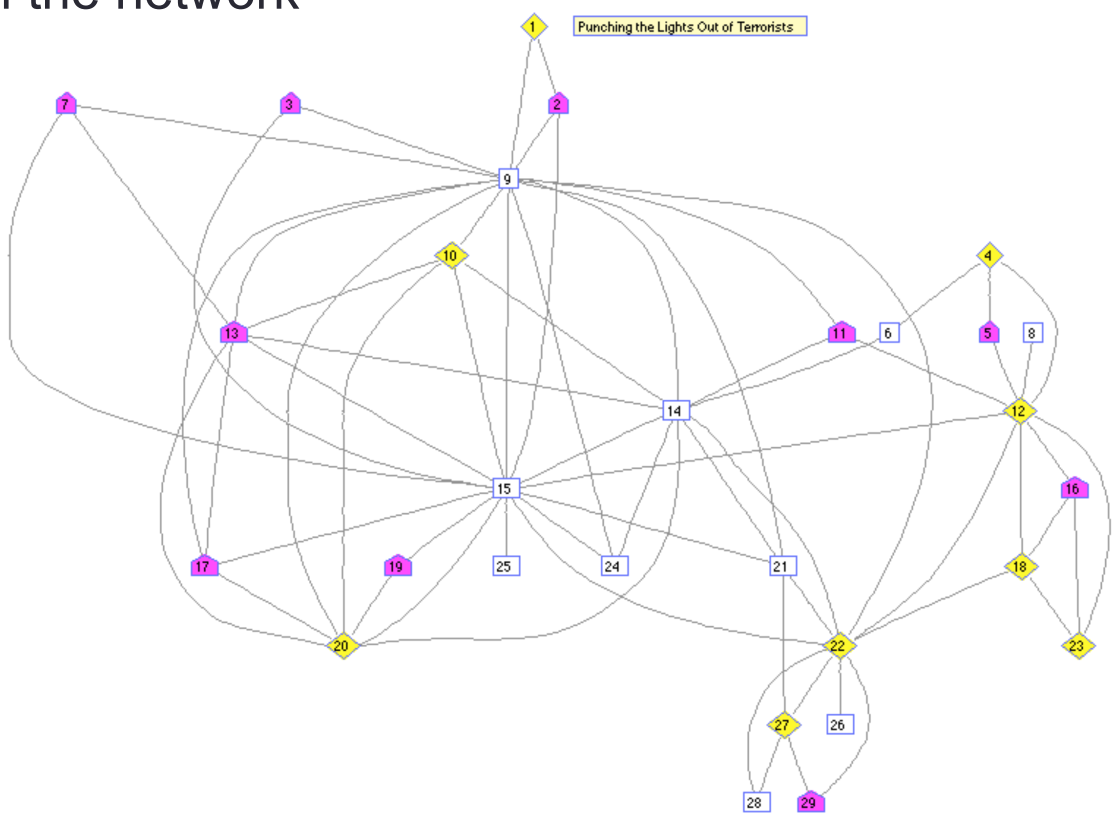
LIGHTS OUT!

Hamsini Sriraman

Purpose

- Solve the *Lights Out* puzzle using modular arithmetic
- Our initial condition is the network we used in the Social Networks lab
- Goal: figure out which ‘buttons’ to press to knock out all of the terrorists in the network



Functions

- Gaussp(A+I,-v) – puts matrix in upper triangular form
  - A+I is adjacency matrix + identity matrix
  - -v is the initial condition of the network
  - Use mod command to make matrix entries 0 or 1
  - Skip columns with no remaining 1s
  - Delete rows which are all 0s
- Trisolve(A+I,-v) – solves for the matrix given initial condition
  - Use mod command to make matrix entries 0 or 1

Modifications

- In gaussp, skip to next column when you encounter a bad column
  - Do not skip down to the next row (might skip entries that need to be row-reduced)

```
function x = gauss(S,f)
n = length(f);
S = [S | f]     Augment S with f
for k=1:n-1     k counts columns
    r = row number, larger than or equal to k,
        with largest value (in magnitude) in column k
    if this largest value is really small then warn the user
    swap row r and row k
    for j=k+1:n
        mix row k into row j in order to eliminate S(j,k)
    end
end
if S(n,n) is really small then warn the user
strip off the changed f, i.e., copy column n+1 of S onto f
x = trisolve(S,f)
return
```

Modular Arithmetic

e ven”	“o dd”
e ven”	“o dd”
o dd”	“e ven”

and

→/	“e ven”
“e ven”	“e ven”
“o dd”	“e ven”

is the same as:

+	0	1
0	0	1
1	1	0

and

→/	0	1
0	0	0
1	0	1

1 + 1 + 1 + 1 + 1 = 5 ⌘ 1 mod 2

1 + 1 + 1 + 1 + 1 = (1 + 1) + (1 + 1 + 1) = 2 + 3 ⌘ 0 + 1 mod 2 ⌘ 1 mod 2

1 + 1 + 1 + 1 + 1 = 5 /←(1 + 1 + 1 + 1 + 1) = 5 /← 1 ⌘ 1 /← 1 mod 2 ⌘ 1 mod 2