$\gcd(a,b) = \gcd(b, a\%b)$

trace: $\gcd(9, 12)$

$\gcd(12, 9)$

$\gcd(9, 3) = 3$ (base case: $b | a$).

Extended GCD:

Recall that $\gcd(a,b) = ua + bv$ some $u, v \in \mathbb{Z}$

(in fact, $\gcd(a,b) = \min_{u,v \in \mathbb{Z}} \{ua + bv\}$)

Sketch: add by reference parameters for u,v

```
int gcd(int a, int b, int& u, int& v) {
        // base case
        if(a%b ==0) {
            u= 0;
            v= 1;
            return b; //= 0a + 1b
        }
      //Now assume gcd works for smaller input:
      int u', v';
     int d = gcd(b, a%b, u', v');
    //Now we know u'·b + v'(a%b) = d.
   //Note: a%b = a-(a/b)·b
   // multiply, gather a,b terms... set u, v...
   ...
   return d;
}
```

Back to subsets:

Write a function that computes $\mathcal{P}(S)$, the set of all subsets.

We'll work with vectors.

input: [1, 2, 3]

output: [[ ], [1], [2], [3], [1,2], [1,3], [2,3], [1,2,3]]

if v.size() = n, then $|\mathcal{P}(V)| = 2^n$.

v[0],	v[1],	v[2]	
1	0	0	[1]
0	1	0	[2]
0	0	1	[3]
1	1	0	[1, 2]
1	0	1	[1, 3]
0	1	1	[2, 3]
1	1	1	[1, 2, 3]
0	0	0	[ ]

Now for the algorithm:

input: [1, 2, 3].

if we call on [1, 2], we get

[[ ], [1], [2], [1,2]]

These all work, but we're missing all the subsets that had 3.

Answer: $\mathcal{P}(V \setminus \{3\}) \cup$ "$\mathcal{P}(V \setminus \{3\})$ with 3 added to each elem't"