Admin stuff:

Evaluation: No midsem exam

Final exam – 30%

Assignments – 50%

Quizzes – 20%

Teaching Assistants: BSc Math II year

Siddharth K

Arjun Arul

Anudhyan Boral

moodle.cmi.ac.in

Use your CMI username

"Forgot password"

Don't use regular CMI password

Textbooks

Reference material on Python

Zero Tolerance for Copying

What is programming?

What is a programming language?

Algorithm is a sequence of instructions

Effective - each instruction can be carried out with no further explanation

Finite

Is a program an algorithm?

Yes.

A specific presentation of an algorithm

Depends on the level of instructions

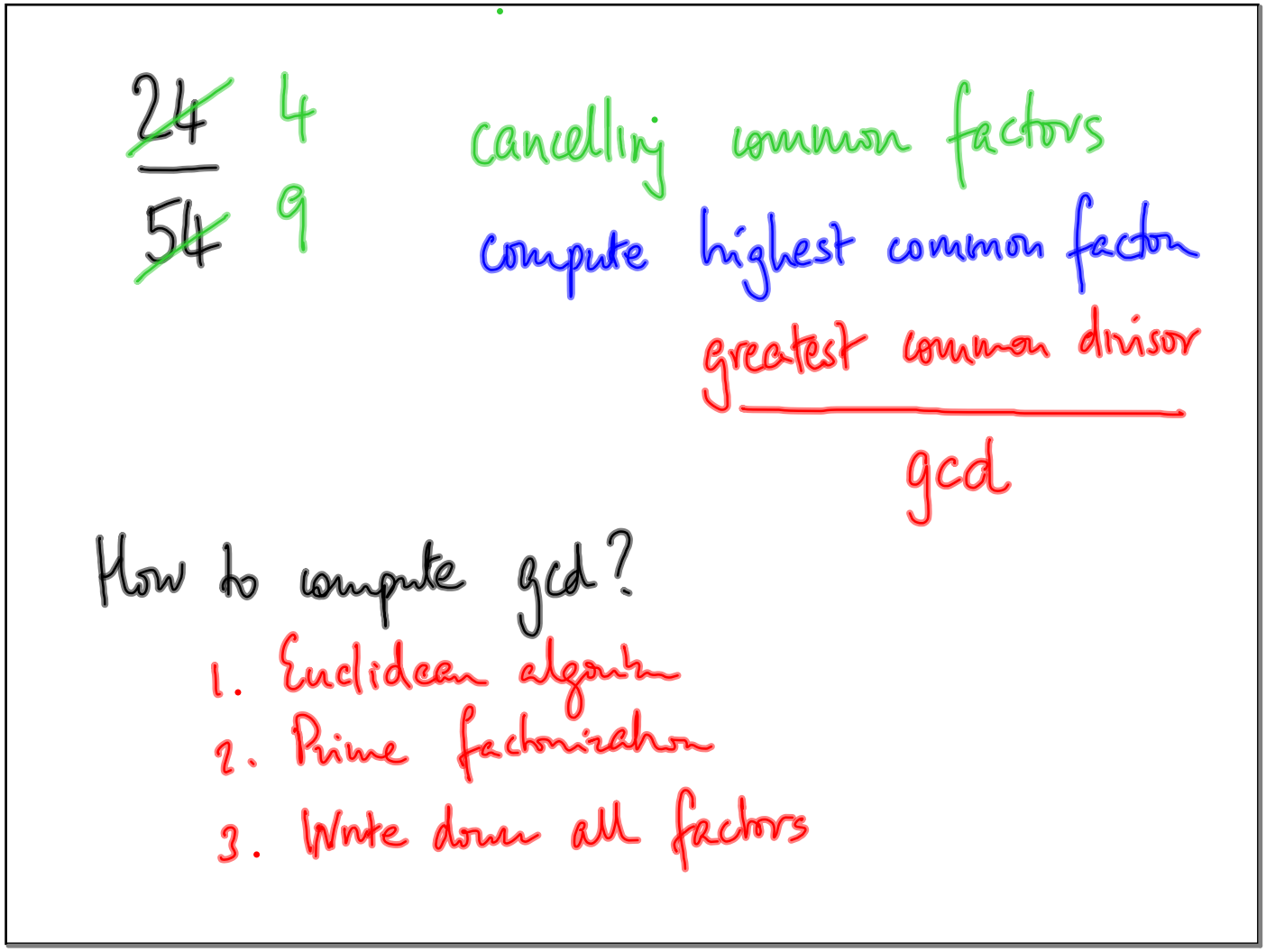
Programming language ≡ decision about what instructions are available

Our language:

Python 3.1 (not 2.x)

Learning programming

Learning a programming language


24/54
4
9
cancelling common factors
compute highest common factor
greatest common divisor
gcd
How to compute gcd?
1. Euclidean algorithm
2. Prime factorization
3. Write down all factors

Factors of n are smaller than n

range: 1, 2, . . , n

try them all out

→ List of divisors

24 — [1, 2, 3, 4, 6, 8, 12, 24]

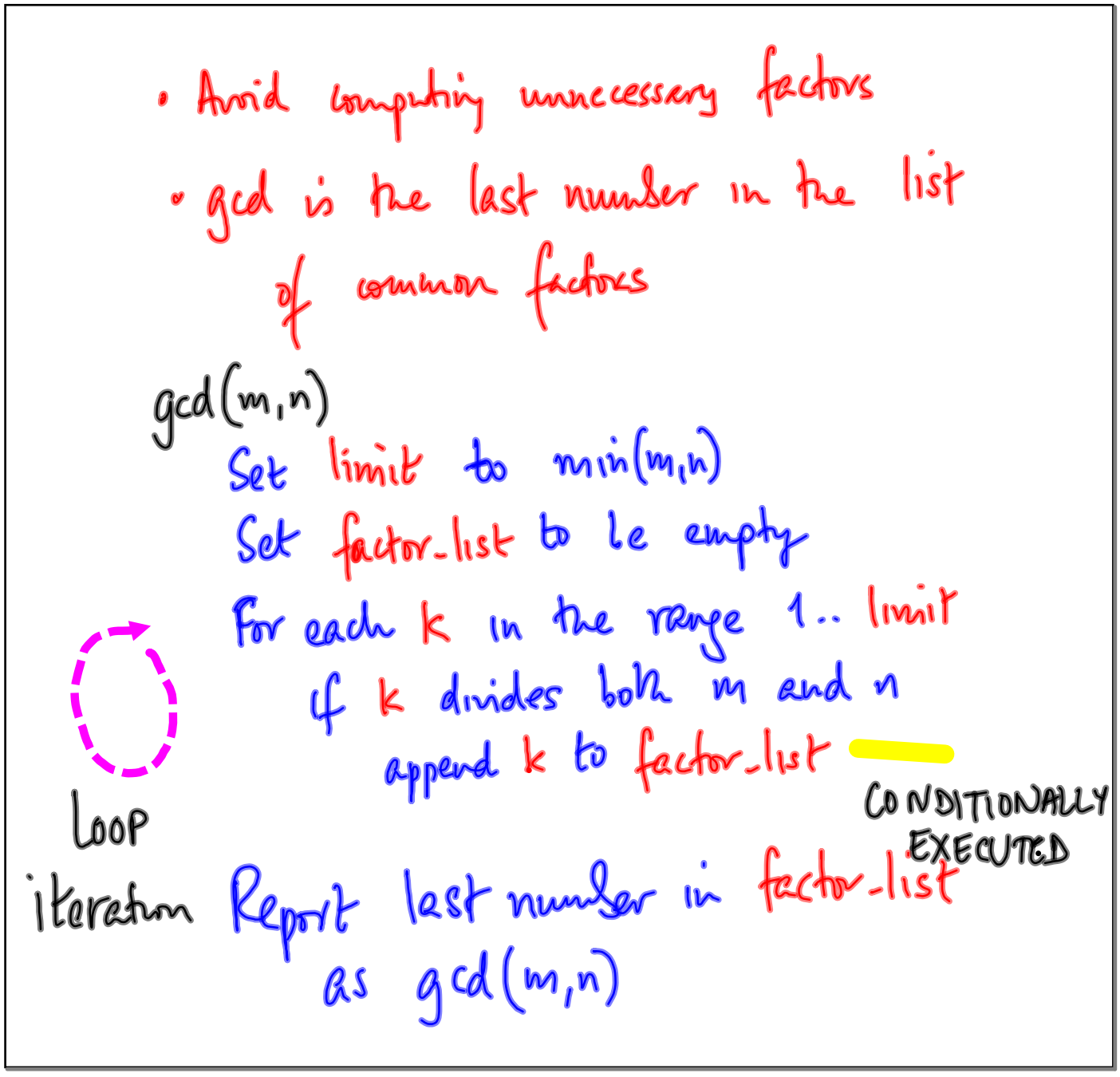
gcd(m,n)

Factors_m is list of factors of m
Factors_n is list of factors of n

Report largest number that appears in both lists

Assume m > n

gcd is in 1..n
Can find all common factors in one scan 1..n


• Avoid computing unnecessary factors
• gcd is the last number in the list of common factors
gcd(m,n)
Set limit to min(m,n)
Set factor_list to be empty
For each k in the range 1.. limit
if k divides both m and n
append k to factor_list
CONDITIONALLY EXECUTED
LOOP ITERATION
Report last number in factor_list as gcd(m,n)

Euclid

k divides m exactly

$m > n$

If $k|m$ and $k|n$ then $k|m-n$

$k|m \Rightarrow m = ak$

$k|n \Rightarrow n = bk$

$m - n = (a-b)k$

If $k|n$ and $k|m-n$ then $k|m$

$n = bk$

$m - n = ak$

$m = n + (m-n)$

$= (a+b)k$

If $m > n$ $\quad gcd(m,n) = gcd(n, m-n)$

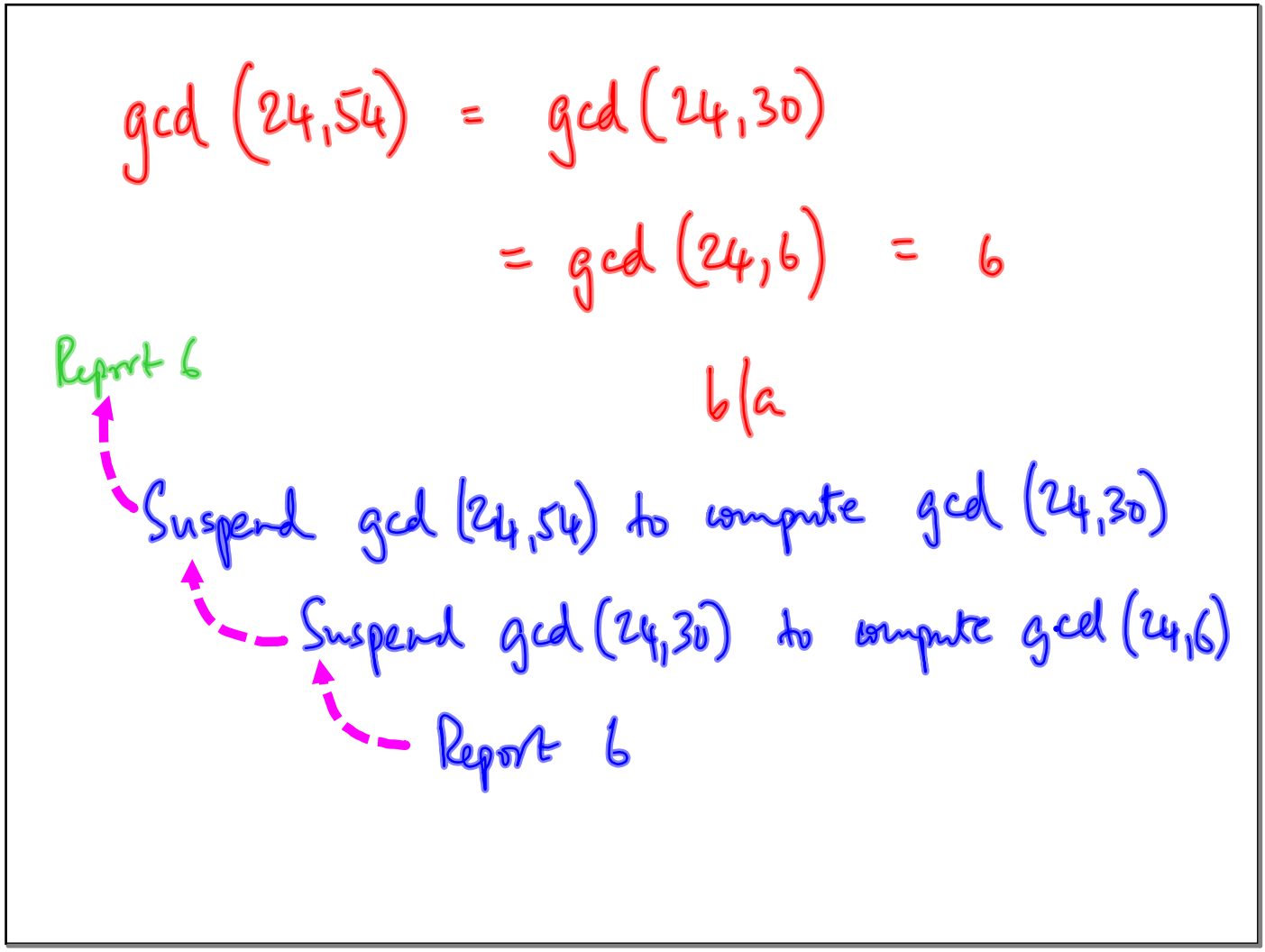
If $n|m$ $\quad gcd(m,n) = n$

gcd_euclid (m,n)

let a = max(m,n)
b = min(m,n)

if b|a
report answer as b

otherwise
report gcd_euclid (b, a-b)


gcd (24,54) = gcd (24,30)
= gcd (24,6) = 6
Report 6
6|a
Suspend gcd (24,54) to compute gcd (24,30)
Suspend gcd (24,30) to compute gcd (24,6)
Report 6

$gcd(101,2) = gcd(2,99) = gcd(2,97) = \ldots$

$\ldots\ldots gcd(2,3) = gcd(2,1) = 1$

Refinement: $m > n$

$$gcd(m,n) = gcd(n, \underbrace{m \bmod n}_{\text{remainder}})$$

$gcd(101,2) = gcd(2,1) = 1$

gcd_refined (m,n)

if n|m

report n

otherwise

report gcd (n, m mod n)

gcd(12,24) = gcd(24,12) = 12