

# COMP108

## Data Structures and Algorithms

### Pseudo code (Part II)

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## Developing pseudo code

- ▶ Suppose x & y are both integers.
- ▶ Write a while loop to output all **factors** of x which are **not** factors of y.

- ▶ Examples of expected results:

x	y	factors of x	output
6	3	<del>1, 2, 3, 6</del>	2, 6
30	9	<del>1, 2, 3, 5, 6, 10, 15, 30</del>	2, 5, 6, 10, 15, 30
3	6	<del>1, 3</del>	-

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- ▶ Skeleton:

$i \leftarrow ?$

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end
  
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```

i ← ?
while ??? do
begin
  if ??? then
    output ???
  i ← ??
end

```

## Factors of x but not factors of y

Steps:

- ▶ Factor of x must be between 1 and x

```
i = 1  
while ( i ≤ x )  
begin  
end i ← i + 1
```

- ▶ If x is divisible by i, then i is a factor of x
- ▶ If y is not divisible by i, then i is not a factor of y
- ▶ We need **both** conditions to hold and then we output i

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```

if x%i == 0 AND y%i ≠ 0 then
  output i
  
```

## Factors of $x$ but not factors of $y$

Summarizing:

A large, empty rounded rectangular box with a thin black border, intended for summarizing the information presented above.

## Factors of $x$ but not factors of $y$

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while i ≤ x do
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i ← 1
while i ≤ x do
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  if x%i == 0 AND y%i ≠ 0 then
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  i ← i+1
end
```

## Finding Lowest Common Multiple (LCM)

Suppose  $x < y$  & both are integers.

Write a while loop to output the **lowest common multiple lcm** of  $x$  and  $y$ , i.e., the smallest number that is divisible by  $x$  and divisible by  $y$ .



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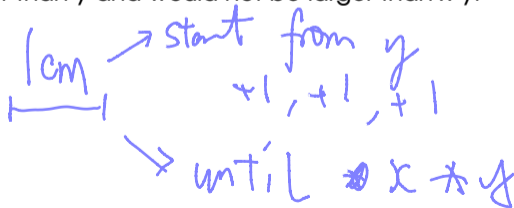
- ▶ So we want
  - ▶  $\text{lcm} \% x$  to be 0
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*lcm* → start from  $y$   
 $+y, +y, +y$

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  - ▶ once we find the smallest one, we should stop

## LCM

```

lcm ← _____, found ← false
while lcm ≤ _____ AND found ≠ true do
begin
  if _____ then
    found ← true
  else lcm ← lcm + _____
end
output lcm

```

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```

~~found ← false~~ true  
 ↑ ↑  
 continue stop  
 found ≠ true

## LCM

```

lcm ←   y  , found ← false
while lcm ≤   x*y   AND found ≠ true do
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  if _____ then
    found ← true
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end
output lcm

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output lcm

```

$$lcm \% x == 0$$

lcm is multiple of x

AND

lcm is multiple of y

$$lcm \% y == 0$$

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lcm ←   y  , found ← false
while lcm ≤   x*y   AND found ≠ true do
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    if   lcm%x==0 AND lcm%y==0   then
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output lcm

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```

lcm ←       , found ← false
while lcm ≤        AND found ≠ true do
begin
    if                    then
        found ← true
    else lcm ← lcm +       
end
output lcm

```



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end
output lcm

```

$$lcm \% x == 0$$

$$\leftarrow y$$

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```

*break?  
not a good  
practice*

## Questions

- ▶ Is the condition " $lcm \leq x*y$ " necessary? *Not necessary*
- ▶ Why do we need to use the flag variable found?
- ▶ What happens if we remove the keyword "else"?

*Approach 1: incorrect answer*

*Approach 2: incorrect answer  $\frac{lcm + 1}{lcm + y}$*

Summary: Developing pseudo code

Next: Exercises on pseudo code

**For note taking**

