

# LAB 09

## Pseudocode

```
GET number

SET list_nums <- [number]
SET francois_number <- 0

WHILE list_nums is not empty

    num <- list_nums[0]                                #A

    IF num > 2                                          #B

        append num - 1 and num - 2 to list_nums

    ELSE IF num = 2                                    #C

        francois_number + 1

    ELSE IF num = 1                                    #D

        francois_number + 2

    REMOVE list_nums[0] in list_nums                  #E

PUT The number is francois_number                     #F
```

## Logarithmic efficiency

$O(2^n)$

Every line in the program is an instant action except for the WHILE loop. At the WHILE loop, it will iterate through the list and the list will expand by two everytime the number is not 1 or 2. So the list could expand exponentially meaning it is very inefficient.

## Program Trace

	list_nums	num	francois_number
A	7	7	0
B	7, 6, 5		
E	6, 5		
A	6, 5	6	
B	6, 5, 5, 4		
E	5, 5, 4		
A	5, 5, 4	5	
B	5, 5, 4, 4, 3		
E	5, 4, 4, 3		
A	5, 4, 4, 3		
B	5, 4, 4, 3, 4, 3		
E	4, 4, 3, 4, 3		
A	4, 4, 3, 4, 3	4	
B	4, 4, 3, 4, 3, 3, 2		
E	4, 3, 4, 3, 3, 2		
A	4, 3, 4, 3, 3, 2		
B	4, 3, 4, 3, 3, 2, 3, 2		
E	3, 4, 3, 3, 2, 3, 2		
A	3, 4, 3, 3, 2, 3, 2	3	
B	3, 4, 3, 3, 2, 3, 2, 2, 1		
E	4, 3, 3, 2, 3, 2, 2, 1		
A	4, 3, 3, 2, 3, 2, 2, 1	4	
B	4, 3, 3, 2, 3, 2, 2, 1, 3, 2		
E	3, 3, 2, 3, 2, 2, 1, 3, 2		
A	3, 3, 2, 3, 2, 2, 1, 3, 2	3	
B	3, 3, 2, 3, 2, 2, 1, 3, 2, 2, 1		
E	3, 2, 3, 2, 2, 1, 3, 2, 2, 1		
A	3, 2, 3, 2, 2, 1, 3, 2, 2, 1		

B	3, 2, 3, 2, 2, 1, 3, 2, 2, 1, 2, 1		
E	2, 3, 2, 2, 1, 3, 2, 2, 1, 2, 1		
A	2, 3, 2, 2, 1, 3, 2, 2, 1, 2, 1	2	
C	2, 3, 2, 2, 1, 3, 2, 2, 1, 2, 1		1
E	3, 2, 2, 1, 3, 2, 2, 1, 2, 1		
A	3, 2, 2, 1, 3, 2, 2, 1, 2, 1	3	
B	3, 2, 2, 1, 3, 2, 2, 1, 2, 1, 2, 1		
E	2, 2, 1, 3, 2, 2, 1, 2, 1, 2, 1		
A	2, 2, 1, 3, 2, 2, 1, 2, 1, 2, 1	2	
C	2, 3, 2, 2, 1, 3, 2, 2, 1, 2, 1		2
E	3, 2, 2, 1, 3, 2, 2, 1, 2, 1		
A	3, 2, 2, 1, 3, 2, 2, 1, 2, 1	3	
B	3, 2, 2, 1, 3, 2, 2, 1, 2, 1, 2, 1		
E	2, 2, 1, 3, 2, 2, 1, 2, 1, 2, 1		
A	2, 2, 1, 3, 2, 2, 1, 2, 1, 2, 1	2	
C	2, 2, 1, 3, 2, 2, 1, 2, 1, 2, 1		3
E	2, 1, 3, 2, 2, 1, 2, 1, 2, 1		
A	2, 1, 3, 2, 2, 1, 2, 1, 2, 1	2	
C	2, 1, 3, 2, 2, 1, 2, 1, 2, 1		4
E	1, 3, 2, 2, 1, 2, 1, 2, 1		
A	1, 3, 2, 2, 1, 2, 1, 2, 1	1	
D	1, 3, 2, 2, 1, 2, 1, 2, 1		6
E	3, 2, 2, 1, 2, 1, 2, 1		
A	3, 2, 2, 1, 2, 1, 2, 1	3	
B	3, 2, 2, 1, 2, 1, 2, 1, 2, 1		
E	2, 2, 1, 2, 1, 2, 1, 2, 1		
A	2, 2, 1, 2, 1, 2, 1, 2, 1	2	
C	2, 2, 1, 2, 1, 2, 1, 2, 1		7
E	2, 1, 2, 1, 2, 1, 2, 1		
A	2, 1, 2, 1, 2, 1, 2, 1	2	
C	2, 1, 2, 1, 2, 1, 2, 1		8

E	1, 2, 1, 2, 1, 2, 1		
A	1, 2, 1, 2, 1, 2, 1	1	
D	1, 2, 1, 2, 1, 2, 1		10
E	2, 1, 2, 1, 2, 1		
A	2, 1, 2, 1, 2, 1	2	
C	2, 1, 2, 1, 2, 1		11
E	1, 2, 1, 2, 1		
A	1, 2, 1, 2, 1	1	
D	1, 2, 1, 2, 1		13
E	2, 1, 2, 1		
A	2, 1, 2, 1	2	
C	2, 1, 2, 1		14
E	1, 2, 1		
A	1, 2, 1	1	
D	1, 2, 1		15
E	2, 1		
A	2, 1	2	
C	2, 1		16
E	1		
A	1	1	
D	1		18
E	/		
F			18