

# Algorithmic Thinking for Migrants Teachers Education

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## Handout #8: Santa's Claus problem

### EXERCISE #1

Santa Claus was preparing 1024 same gifts for the Christmas period. But an elf accidentally put a dirty Santa's sock in one of the 1024 packages. Santa, having a scale that can only do 10 weighings, must definitely find the box with the dirty sock. Can you help Santa?



### Solution:

We divide the pile of 1024 packages into two parts. This means that, we have two parts of  $1024/2 = 512$  packages but one of them weights more than the other. We weigh these two piles and keep the lighter as the correct one and continue the divide and weight procedure for the remaining packages until exhaust the 10 weighings or find the problematic package.

### Weighings:



1<sup>st</sup> weighing :  $1024/2 = 512$  packages.

2<sup>nd</sup> weighing :  $512/2 = 256$  packages.

3<sup>rd</sup> weighing :  $256/2 = 128$  packages.

4<sup>th</sup> weighing :  $128/2 = 64$  packages.

5<sup>th</sup> weighing :  $64/2 = 32$  packages.

6<sup>th</sup> weighing :  $32/2 = 16$  packages.

7<sup>th</sup> weighing :  $16/2 = 8$  packages.

8<sup>th</sup> weighing :  $8/2 = 4$  packages.

9<sup>th</sup> weighing :  $4/2 = 2$  packages.

10<sup>th</sup> weighing :  $2/2 = 1$  package.