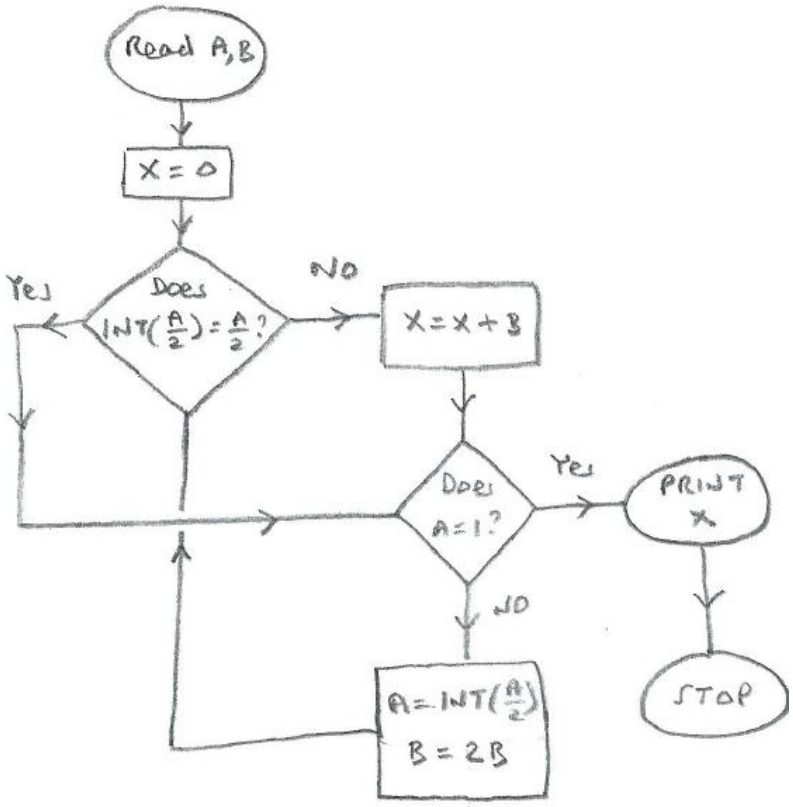
Algorithms – Q9 (22/11/23)

Perform some traces for the following flowchart, in order to establish its purpose.



Solution

$A = 4,\ B = 7$

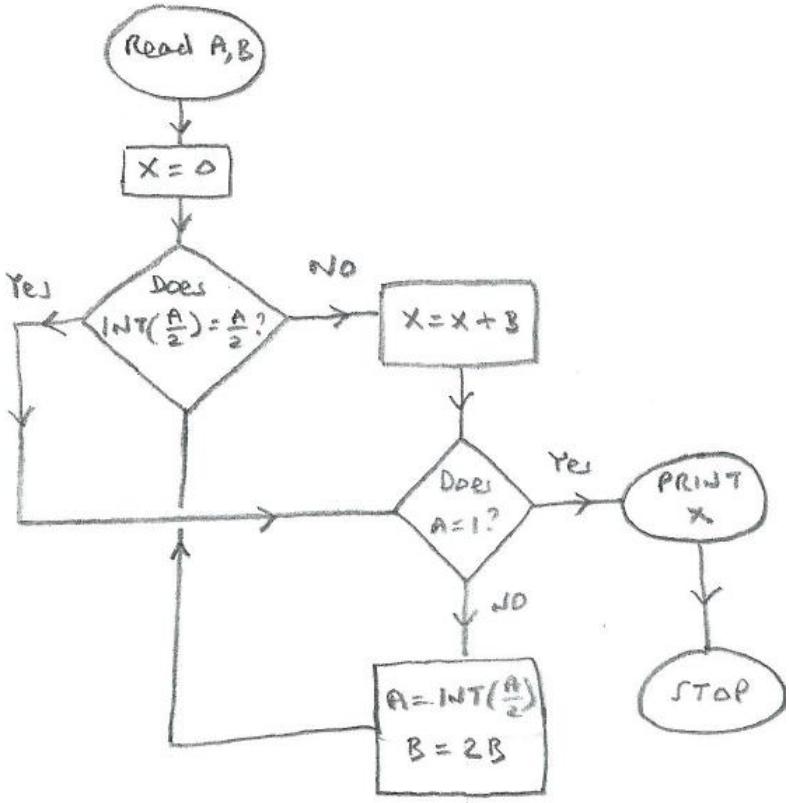
$X = 0$

$A = 2,\ B = 14$

$A = 1,\ B = 28$

$X = 28$

Print 28



$A = 4,\ B = 6$

$X = 0$

$A = 2,\ B = 12$

$A = 1,\ B = 24$

$X = 24$

Print 24

$A = 19,\ B = 6$

$X = 0$

$X = 6$

$A = 9,\ B = 12$

$[19 \times 6 = 6 + 18 \times 6$

$= 6 + 9 \times 12]$

$X = 6 + 12 = 18$

$A = 4,\ B = 24$

$[6 + 9 \times 12$

$= 6 + 12 + 8 \times 12$

$= 18 + 4 \times 24]$

$A = 2, B = 48$

$[18 + 4 \times 24$

$= 18 + 2 \times 48]$

$A = 1, B = 96$

$[18 + 2 \times 48$

$= 18 + 1 \times 96]$

$X = 18 + 96 = 114$

Print 114

The algorithm is multiplying two numbers. It is using the idea that (for the 3rd example):

$8 \times 12 = 4 \times 24 = 2 \times 48 = 1 \times 96$

(it being relatively easy to divide an even number by 2, and to multiply by 2)

When faced with eg 9×12 (with 9 not being an even number), the algorithm splits this into $12 + (8 \times 12)$.