A more precise rounding algorithm for rational numbers

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The purpose of this note is to correct a mistake in the article [1]. An error crept into algorithm 4, the more precise rounding. The algorithm does not work for inputs < 1 , in that it then always gives the result $1/0$. The error consists in the extra condition “ $X_1 \geq X$ and” in the test following the comment “{now look ahead:}”. This extra condition is to be deleted. The correct algorithm goes as follows:

```
input  $t = r/s$ 
 $X_1 := r, X := s$ 
 $P_1 := 0, Q_1 := 1, P := 1, Q := 0$ 
 $NoOverflowSoFar := \mathbf{true}$ 
while  $X > 0$  do
   $K := 0$ 
  while  $NoOverflowSoFar$  and  $(X_1, X)$  is not aligned for division do
    if  $2 \cdot P / 2 \cdot Q \in S$  then
       $P := 2 \cdot P, Q := 2 \cdot Q, X := 2 \cdot X, K := K + 1$ 
    else
       $NoOverflowSoFar := \mathbf{false}$ 
    end if
  end while
```

The online version of the original article can be found under doi:[10.1007/s00607-008-0006-7](https://doi.org/10.1007/s00607-008-0006-7).

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```

{now look ahead:}
if NoOverflowSoFar and  $P_1 + P / Q_1 + Q \in S$  then
  repeat
    if  $X_1 \geq X$  then
       $NoOverflowSoFar := (P_1 + P / Q_1 + Q \in S)$ 
      {please note above the difference to algorithm 3}
      if NoOverflowSoFar then
         $P_1 := P_1 + P, Q_1 := Q_1 + Q, X_1 := X_1 - X$ 
      end if
    end if
    if  $K > 0$  then
       $X_1 := 2 \cdot X_1, P := P / 2, Q := Q / 2$ 
    end if
     $K := K - 1$ 
  until  $K < 0$ 
else
  {recover convergent:}
  while  $K > 0$  do
     $P := P / 2, Q := Q / 2, K := K - 1$ 
  end while
   $X := 0$  {to exit “while”}
end if
  interchange ( $X, X_1$ ), interchange ( $P, P_1$ ), interchange ( $Q, Q_1$ )
end while
 $Result := P/Q, Preceding\ Convergent := P_1/Q_1$ 
return Result, Preceding Convergent

```

Reference

1. Thill M (2008) A more precise rounding algorithm for natural numbers. *Computing* 82(2–3):189–198