Incremental Correctness

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Increment(y):
if y = 0 then return(1) else
if (y mod 2) = 1= then
return (2 · Increment(y/2))
else return (y + 1)

Solution:

1. Base case n=0
   Clearly if n=0 then Increment(0) returns 1.

2. Assume true for all n<y prove for n = y + 1
   When n is even, ie. n=2k then.

   Increment(2k)
   2k mod 2 = 0 > return 2k + 1

   If n is odd such that n = 2m + 1

(2m + 1 mod 2) = 1
then

$$
\begin{aligned}
2.increment([2m+1]/2) &= 2.increment([m+1/2]) \\
&= 2.increment(m) \\
&= 2(2m+1) \\
&= 2m+2 = y+1
\end{aligned}
\tag{1}
$$