$$\dfrac{\dfrac{n \geq 0 \Rightarrow I\{0/r, 0/i, 1/p\}}{\{n \geq 0\}\, r := 0; i := 0; p := 1\, \{I\}} \qquad \dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\{I[(r+p)/r\,, (2*p)/p(i+1)/i]\} r := r - p \{I[(2*p)/p, (r+p)/r, (i+1)/i]\}}{I \wedge not(i = n) \Rightarrow \{I[(2*p)/p, (r+p)/r, (i+1)/i]\}} \{I[(2*p)/p, (r+p)/r, (i+1)/i]\} p := 2*p; r := r+p; i := i+1 \{I\}}{\{I \wedge not(i = n)\}\ r := r - p; p := 2*p; r := r+p; i := i+1\ \{I\}}}{I \wedge (i = n) \Rightarrow r := 2^n - 1}}{\{I\}\, while\; not(i = n)\; do\; r := r - p; p := 2*p; r := r+p; i := i+1\, \{r := 2^n - 1\}}}{\{n \geq 0\}\, r := 0; i := 0; p := 1\; while\; not(i = n)\; do\; r := r - p; p := 2*p; r := r+p; i := i+1\, \{r := 2^n - 1\}}$$

I is invariant for this loop, and it must satisfy the following constrains:

$$n \geq 0 \Rightarrow I\{0/r, 0/i, 1/p\}$$

$$I \wedge not(i = n) \Rightarrow \{I[(2*p)/p, (r+p)/r, (i+1)/i]\}$$

$$I \wedge (i = n) \Rightarrow r := 2^n - 1$$

Let I=$p = 2^i \wedge r = 2^i - 1 \wedge i \leq n$ then

$$n \geq 0 \Rightarrow 1 = 2^0 \wedge 0 = 2^0 - 1 \wedge 0 \leq n$$

$$p = 2^i \wedge r = 2^i - 1 \wedge i \leq n \wedge (i \neq n) \Rightarrow 2p = 2^{i+1} \wedge r + 2^i = 2^{i+1} - 1 \wedge i + 1 \leq n$$

$$p = 2^i \wedge r = 2^i - 1 \wedge i \leq n \wedge (i = n) \Rightarrow r = 2^n - 1$$

All the constrains are correct, so the program is right.