Salamin–Brent Algorithm

initial values: $a_0 = 1, \quad b_0 = \frac{1}{\sqrt{2}}, \quad s_0 = \frac{1}{2}$

Repeat:

iteration 1

$$a_1 = \frac{a_0 + b_0}{2} = \frac{1 + \frac{1}{\sqrt{2}}}{2}$$

$$b_1 = \sqrt{a_0 b_0} = \sqrt{1 \cdot \frac{1}{\sqrt{2}}} = \sqrt{\frac{1}{\sqrt{2}}}$$

$$s_1 = \frac{1}{2} - 2^1\left(a_1^2 - b_1^2\right) = \frac{1}{2} - 2\left(\left(\frac{1+\frac{1}{\sqrt{2}}}{2}\right)^2 - \left(\sqrt{\frac{1}{\sqrt{2}}}\right)^2\right)$$

$$p_1 = \frac{2a_1^2}{s_1} = \frac{2\left(\frac{1+\frac{1}{\sqrt{2}}}{2}\right)^2}{s_1} = 3.187\ldots$$

iteration 2

$a_2 = \cdots$

$b_2 = \cdots$

$s_2 = \cdots$

$p_2 = \cdots$