

MATH 242 — 15 Sept. 2025

Salamin-Brent Algorithm

m : num. iterations

Initialize $a_0 = 1$

$$b_0 = 1/\sqrt{2}$$

$$s_0 = 1/2$$

Loop: $a_1 = \frac{1}{2}(a_0 + b_0) = \frac{1}{2}\left(1 + \frac{1}{\sqrt{2}}\right)$

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

$$s_1 = s_0 - 2^1(a_1^2 - b_1^2) = \frac{1}{2} - 2\left(\left(\frac{1}{2}\left(1 + \frac{1}{\sqrt{2}}\right)\right)^2 - \left(\sqrt{1 \cdot \frac{1}{\sqrt{2}}}\right)^2\right)$$

$$p_1 = \frac{2a_1^2}{s_1} =$$

Repeat for a_2, b_2, s_2, p_2

Repeat for a_3, b_3, s_3, p_3

$\vdots$

etc.

$\vdots$

a_m, b_m, s_m, p_m

Finally, return p_m , which approximates π .

