Exercise 2. Rewrite the following polynomials in nested form and evaluate at $x = -1/2$:

(a) $P(x) = 6x^3 - 2x^2 - 3x + 7$

(b) $P(x) = 8x^5 - x^4 - 3x^3 + x^2 - 3x + 1$

(c) $P(x) = 4x^6 - 2x^4 - 2x + 4$

Solution.

Exercise 3. Evaluate $P(x) = x^6 - 4x^4 + 2x^2 + 1$ at $x = 1/2$ by considering $P(x)$ as a polynomial in x^2 and using nested multiplication.

Solution.

Exercise 6. Explain how to evaluate the polynomial for a given input x, using as few operations as possible. How many multiplications and how many additions are required?

(a) $P(x) = a_0 + a_5x^5 + a_{10}x^{10} + a_{15}x^{15}$

(b) $P(x) = a_7x^7 + a_{12}x^{12} + a_{17}x^{17} + a_{22}x^{22} + a_{27}x^{27}$

Solution.

Computer problem 1. Use the function `nest.m` (or `simplenest.m`) to evaluate

$$P(x) = 1 + x + x^2 + \cdots + x^{50}$$

at $x = 1.00001$. (Use the MATLAB `ones` command to save typing.) Find the error of the computation by comparing with the equivalent expression $Q(x) = (x^{51} - 1)/(x - 1)$.

Solution.

Computer problem 2. Use `nest.m` (or `simplenest.m`) to evaluate

$$P(x) = 1 - x + x^2 - x^3 + \cdots + x^{98} - x^{99}$$

at $x = 1.00001$. Find a simpler, equivalent expression, and use it to estimate the error of the nested multiplication.

Solution.