1. An alternate form of the Adem relations is given by

\[ \sum_{j=0}^{k} \binom{k}{j} Sq^{2n-1-j} Sq^{n-k+j} = 0. \]

This is valid for \(0 \leq k \leq n\). Show that these equations for \(k = 0, 1, 2, 3\) are equivalent to four of the Adem relations.

2. Show that the following elements commute with each other and square to zero, generating an exterior algebra on three generators.
   - \(Q_0 = Sq^1\)
   - \(Q_1 = [Sq^2, Q_0] = Sq^2 Sq^1 + Sq^1 Sq^2\)

(These are referred to as the first two Milnor primitives. The Milnor primitives are defined (in one way) by \(Q_{i+1} = [Sq^{2i}, Q_i]\), and generate an exterior algebra on infinitely many generators.)

3. Describe \(H^*(\mathbb{C}P^3 \times \mathbb{C}P^2)\) together with its action of the mod-2 Steenrod algebra.

4. Find the smallest possible subalgebra of the mod-2 Steenrod algebra generated by \(Sq^1\) and \(Sq^2\).