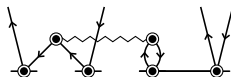


1. Give an example of each of the following.
 - (a) A closed, connected graph of at least two operators.
 - (b) A Hugenholtz path of at least three lines that doesn't qualify as a Goldstone path.
 - (c) Non-equivalent, interchangeable subgraphs, where at least one subgraph contains multiple operators.
 - (d) A graph that is disconnected and linked.

2. Interpret the following graph algebraically, and then simplify your expression as much as possible.¹



¹The operators in this graph are defined as follows.

$$\text{Diagram: two vertices connected by a wavy line} \equiv \left(\frac{1}{2!}\right)^2 \sum_{pqrs} \bar{g}_{pq}^{rs} \tilde{a}_{rs}^{pq}$$

$$\text{Diagram: one vertex with two incoming lines} \equiv \sum_{ia} c_a^i \tilde{a}_i^a$$

$$\text{Diagram: two vertices connected by a straight line} \equiv \left(\frac{1}{2!}\right)^2 \sum_{ijab} c_{ab}^{ij} \tilde{a}_{ij}^{ab}$$

$$\sum_{\substack{abcd \\ ijkl}} \overline{v}_{ij}^{ab} \overline{w}_{bcd}^{jkl} :: a_{ab}^{ij^\circ} \bullet a_{j^\circ kl}^{b \bullet cd} ::$$

²Use the following to denote the operators in your graph.

$$\left(\frac{1}{2!}\right)^2 \sum_{pqrs} \bar{v}_{pq}^{rs} \tilde{a}_{rs}^{pq} \equiv \boxed{v} \text{---} \text{---} \text{---} \text{---}$$

$$\left(\frac{1}{3!}\right)^2 \sum_{\substack{pqr \\ stu}} \bar{w}_{pqr}^{stu} \tilde{a}_{stu}^{pqr} \equiv \boxed{w} \text{---} \text{---} \text{---}$$