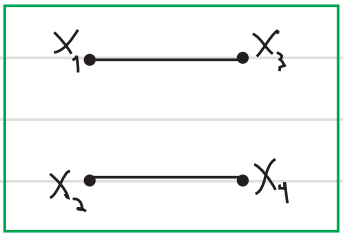
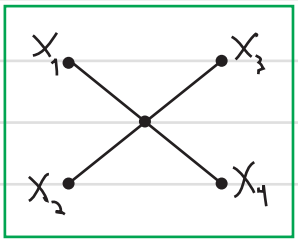
1 Consider the following diagrams:

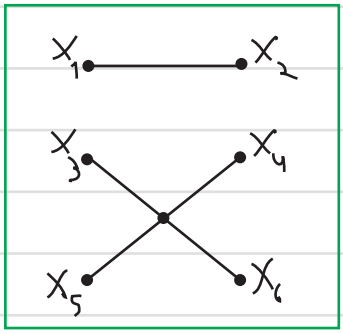
(I)



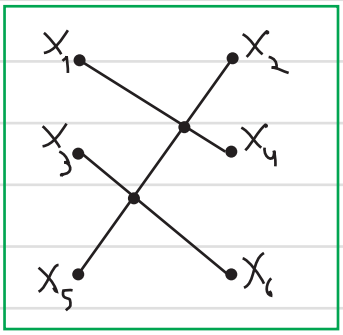
(II)



(III)



(IV)



a Write the position and momentum space Green functions for all of them ($\lambda\phi^4$):

$G_n(x_1, \dots, x_n)$ & $\tilde{G}_n(p_1 \dots p_n)$

(attention, I'm asking for $\tilde{G}$, not the S matrix element, this is BEFORE applying LSZ formula - if you can just write them do it, no need to calculate anything)

b Consider the LSZ formula, particularized to when all $Z = 1$ and all $m_i = m$:

$$\langle \{p_i\}_n | \{k_j\}_m \rangle_{OUT} = \lim_{\substack{p_i^2 \to m^2 \\ k_j^2 \to m^2}} \frac{1}{(i)^{n+m}} \prod_{i=1}^{n} (p_i^2 - m^2 + i\epsilon) \prod_{j=1}^{m} (k_j^2 - m^2 + i\epsilon)\, \tilde{G}_{n+m}(\{p_i\}, \{k_j\})$$

Compare what happens when you apply that formula to diagrams (I) and (II) above. What about (III) and (IV)?

c Which diagrams above would contribute to a $(2 \to 2)$ scattering? Which would contribute to a $(2 \to 4)$ scattering?