$$\mathbf{A} \times \mathbf{B} = \{\langle 1, \dagger \rangle, \langle 2, \dagger \rangle, \langle 3, \dagger \rangle, \langle 4, \dagger \rangle, \langle 1, * \rangle, \langle 2, * \rangle, \langle 3, * \rangle, \langle 4, * \rangle\}$$