Problem 1

Option 1

$$\mathcal{L}_{coupled}(A, \Theta) = ||A - PQ^T||_F^2 + ||X - PG^T||_F^2 + ||Y - QW^T||_F^2$$

Option 2

$$\mathcal{L}_{coupled}(A, \Theta) = ||A - PQ^T||_F^2 + ||X - PG^T||_F^2 + ||YW - Q||_F^2$$

Because first two addendums are the same, in terms of difference in memory usage, we can shorten our losses

Option 1

$$\mathcal{L}_{coupled}(A, \Theta) = ||Y - QW^T||_F^2$$

Option 2

$$\mathcal{L}_{coupled}(A, \Theta) = ||YW - Q||_F^2$$

For the item cold-start scenario (y^* - new item)

Option 1

$$q^* = argmin_q||y^* - qW^T||_2^2$$

Option 2

$$q^* = argmin_q||y^*W - q||_2^2$$

In first option, for calculating q^*, we need to solve linear equation $qW^T = y^* \implies Wq^T = y^{*T}$ with unknown q^T, which needs extra memory and cpu for calculating.

In second option we can calculate q^* straight like $q^* = y^*W$ without extra memory at all with only one matvec

So, that's why the second option is more prefferable for item cold-start scenario in terms of both memory and cpu usage