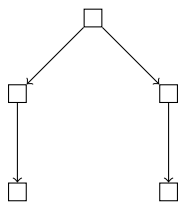


# Solution ‘Family ties’

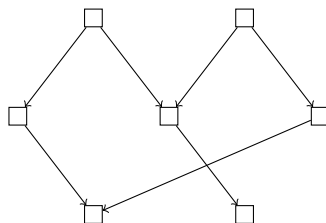
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**Structure:** each person in Generation I is the grandparent of every person in Generation III, but these grandchildren are not siblings, which means that you know that at least the following structure must appear under each grandparent:



The situation where the two grandparents have two children together will not happen; we cannot assign a parent for the third person in Generation II. We end up with the following relationships:



Note that the persons in each generation are interchangeable.

**Decoration:** first conclude that persons in Generation III cannot have green eyes; if so, their parents and grandparents will have green eyes as well, contradicting the fact that there is no person who has the same eye color as one of his parents and one of his grandparents.

There are two persons in the diagram who have both parents present in the figure. We know that exactly one of them has blue eyes and that all other persons have green or brown eyes.

First assume that the one in Generation II has blue eyes. This means that all the persons in Generation III have brown eyes. Moreover, one of the persons in Generation I has brown eyes. Now we have a person in generation II who has no blue eyes, a parent with brown eyes and a child with brown eyes. We cannot

assign any eye color to this person, so this was not the right track. From now on we can assume that the one in generation III has blue eyes.

So, this gives us the eye color of everyone in Generation III and of the parents, in Generation II, of the person with blue eyes. Note that the parent of the parent with green eyes has green eyes as well. The eye color of the other person in Generation I is green as well; it is not blue, and it is not brown, because that will give us the same situation that caused trouble before.

This means that we have derived the eye color of six persons in the schema. Now we will focus on the hair colors.

First note that if someone in Generation II has black hair, the whole second Generation has black hair. Moreover this means that, since there needs to be someone with green eyes and brown hair, one person in Generation I must have brown hair. However, having brown hair means having a child with brown hair, but we concluded that everyone in Generation II has black hair. Thus, there cannot be anyone in Generation II with black hair.

We know that there are two persons with black hair and the same eye color. Since we excluded everyone from Generation II, the only option left is that the grandparents both have green eyes and black hair.

We know that there are six combinations of hair and eye color appearing and there are seven persons, which means that there is exactly one combination appearing twice: green eyes and black hair, in generation I. So, we need to make sure that all others have unique combinations.

Clearly, five persons with blonde hair is ruled out. Having three persons with blonde hair is also not an option; the person with blue eyes does not have blonde hair, which means that the three persons with blonde hair can only have green or brown eyes, which leads to another double combination. So, there is exactly one person with blonde hair.

So, both parents of the person with blue eyes do not have black hair and at most one can have blonde hair, which means that at least one of them must have brown hair. Having brown hair means that you have exactly one child with brown hair, so the person with blue eyes must have brown hair.

The other person in Generation III has black hair; if this person has blonde hair, its parent cannot have brown hair, thus having blonde hair as well. If this person has brown hair, there are three persons with brown hair and green or brown eyes, which leads to another double combination. Because this person does not have brown hair, its only parent cannot have brown hair, and has thus blonde hair.

We have now located the only person with blonde hair and we know that persons in Generation II do not have black hair, so the rest in Generation II must have brown hair. We find that there is exactly one person with brown hair and brown eyes. Note that there is one person in Generation II of whom we do not know the eye color. However, this does not matter for the outcome of the puzzle since this person has blonde hair.