As a high school student, Sarah Flannery won the Young Scientist of the Year Award in both her native country Ireland and in all of Europe for her work on public key cryptography. She wrote a book called *In Code* (Workman Press, 2001) about her experiences and her life growing up with her mathematician father. Agent Smith, you might enjoy this book when you get closer to Sarah’s age.

She demonstrates the power of the pigeonhole principle in an amusing way (pp. 298-299). Without going to Dublin, the most populous city in Ireland, and without counting any hairs on any heads, she proves that there are two people in Dublin that have exactly the same number of hairs on their heads. We summarize her argument here.

Let’s imagine the largest possible head half covered with very fine hair. We are trying to figure the most number of hairs any person could possibly have. Sarah imagines a sphere (a ball) about one foot in diameter. Of course, she was working with metric system measurements. Wow, that’s an enormous head. If the top half were covered in very fine hairs and we overestimated how many per square inch and how many all together, we would have the maximum possible number of hairs on a head. It’s called an upper bound.

Sarah’s calculations lead us to believe that everyone in Dublin has a number of hairs less than 1,450,000. Now here comes the pigeonhole part. Since there are more than 1,500,000 people in Dublin—that’s a million and a half, Smith—there are not enough different numbers (pigeonholes) to allow everyone to have a different number of hairs. Some people must have matching numbers of hairs!