Department of Mathematics

Maths 190 and Maths 190G
Lecture 3 Summary

In this lecture we illustrate two important observations:

- It's possible to estimate very large numbers of things by breaking one large problem down into a lot of smaller ones.
- The pigeonhole principle. This principle says that if you have to put N things into N-1 boxes, at least one box has to have two things in it.

In Lecture 3 we studied two main questions:

Question 1: How many mini-Crunchie bars would it take to fill up the lecture room?
To answer this, we filled a 1 litre pot with bars and counted how many bars it contained. We then estimated the volume of the room in litres. From that we could calculate how many bars would be needed to fill the lecture room.

This gave us an idea of how to estimate large numbers of things, by counting the number in a smaller region and multiplying up.

We illustrated the pigeonhole principle by using Crunchie bars in jars. If you have nine jars, each of which can hold a maximum of six bars, you know that at least two jars must contain the same number of bars. It's easy to see when using small numbers like this, and then the principle can be applied to Question 2.

Question 2: Are there two people with the identical number of hairs on their body?
First, we estimated the maximum number of hairs a person could have on their body. We did this the same way as Question 1, by counting the number in a smaller region, and multiplying up.
We then compared this number to the total number of people in the world, and applied the pigeonhole principle.

The answer is YES, there must be at least two such people!

Before you come to the next lecture: You should spend an hour or two thinking and reading about the ideas presented in the lecture. You should also:

- Read 2.2 in the text and think about other patterns you see in nature, or around you in your daily life.

Other activities you could do if you have time are:

- Try out the hairy body question on a friend or family member. Can they figure out the answer?
- Bring along about 1 million of something to the tutorial and describe how you estimate the number to be about 1 million.