Department of Mathematics

Maths 190 and Maths 190G Tutorial 2

Please remember that part of your final mark for the course depends on your participation and enthusiasm in tutorials: you can get up to 10 marks towards your final mark by attending and actively participating in all tutorials. Up to 15 marks more will be awarded for the quality of your write-up of selected tutorial questions. **Only the question appearing in a box needs to be written up.** Details on submitting the write-up appear at the end.

By discussing the following situations with your tutorial group, try to work out together a solution to each of the following questions. Make sure everyone in the group contributes to the discussion. When you have an answer to a question that everyone agrees with, make some notes outlining how you worked out the answer. Then try to explain your answer to your tutor or lecturer.

1. (Mindscape 4, Chapter 2.1 of the textbook). You have 16 new CDs to put on your empty five-shelf CD rack. Can you place the CDs so that each shelf contains three or fewer CDs? Can you arrange them so that each shelf gets exactly three?

To be handed in with Assignment 2:

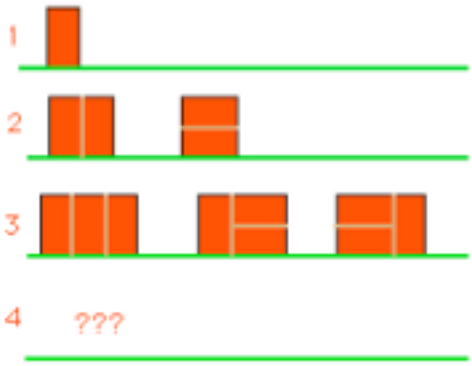
2. (Mindscape 14, Chapter 2.1 of the textbook). You have 10 pairs of socks, five black and five blue, but they are not paired up. Instead, they are all mixed up in a drawer. When you stumble out of bed early in the morning (to get to an early math lecture, which you could not possibly miss) you can't turn on the light in case you wake up your pet sheep who sleeps under your bed. So you start pulling socks out of the drawer in the darkness. How many socks must you pull out to guarantee that you have a pair of one colour? How many must you pull out to guarantee you get two pairs of socks (each a matching pair)? How many must you pull out to guarantee you get a black pair? Do you even care if your socks match?

3. (Mindscape 15, Chapter 2.1 of the textbook). Play this game with natural numbers. You start with any number. If the number is even, divide it by 2. If the number is odd, multiply it by 3 and add 1. Keep on repeating this process. You win if you ever get to 1. For example, if we start with 17, we would have

17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1.

Play four rounds starting with the numbers 19, 11, 22 and 30. Do you think you will always win no matter what number you start with?

4. (From http://www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibpuzzles.html).
If we want to build a brick wall out of the usual size of brick which has a length twice as long as its height, and if our wall is to be two units tall, then we can build our wall in a number of ways, for any specified wall length. Here are the possibilities for wall lengths 1, 2 and 3:



Notice that there is just one wall pattern which is 1 unit long - made by putting the brick on its end.
There are 2 patterns for a wall of length 2: two side-ways bricks laid on top of each other and two bricks long-ways up put next to each other.
There are three patterns for walls of length 3.
How many patterns can you find for a wall of length 4?
How may different patterns are there for a wall of length 5?

Look at the number of patterns you have found for a wall of length 1, 2, 3, 4 and 5. Does anything seem familiar?
Can you find a reason for this?

5. (If you have time). Give a *rough* estimate of the percentage of land devoted to automobile use in a typical, residentially zoned, district of Auckland. Include all roads, parking spaces and private driveways.

Writing up tutorial questions.

A written solution to **the boxed question above** should be handed in for marking.

- Attach your answer to Mindscape 15 to your answers to **Assignment 2** and hand in with your assignment answers.

Your write-up should include:

- the names of the people you discussed this with in your tutorial group;
- a clear statement of your solution to the puzzle;
- a clear explanation (in one or two paragraphs) or how you arrived at this solution; and,
- a statement of any assumptions you had to make in obtaining your answer.

Marks for the report will be based on the clarity of your writing. You should aim for well-written, polished answers. The markers will not be concerned with the spelling and grammar of your writing, but will pay close attention to the logic of your statements. You may find it helpful to get someone who is not taking this course to read your answer to check that your explanations are clear. You should write your report in your own words. Do not copy from another person or allow another person to copy from you, including the other members of your tutorial group.