CSIT113
Problem Solving

Workshop - Week 12

Red and Blue Island

- Near the Knights & Knaves island there is Red & Blue island
- 222 'perfectly' logical people inhabit Red & Blue island
  - Each has a Blue or Red spot on the back of their head.

- The Red & Blue islanders have no mirrors and never discuss spot colours
  - Nobody knows the colour of their own spot, but they can see the colour of everyone else's
- Each morning everyone on the island gathers in the public meeting place at 6am.
  - Strict custom, which is always followed, dictates that anyone who has determined the colour of their spot during the last day must declare this and leave for ever.
  - They otherwise never leave, die or reproduce.

Red and Blue Island

- One day a rude tourist visits and announces at the morning gathering: "I can see that at least one of you has a red spot."

- The tourist leaves and returns a year later.
  - What has happened? (Assume that the Red & Blue islanders believe the tourist)

- What if the tourist had announced "I can see that at least one of you has a blue spot."?

Smørrebrød (sandwiches)

- You have a part-time job in a Danish Restaurant Chain
- Unfortunately you neither speak nor read Danish
- The rest of the staff neither speak nor read English
- Needless to say, the menu is all Danish to you
- To hide your ignorance you conceive a cunning plan…
- …Go to the same restaurant in a nearby town and learn what all the items on the menu are

Smørrebrød

- There are 10 items on the menu (say A,B,C,D,E,F,G,H,I,J)
- You are a poor student and can't afford to buy all the dishes on the menu
- You can buy a tasting plate with 5 items, in any combination.
- How many plates will you need to buy to learn what every item is?

Tours

- A tour is a path that visits every available location exactly once, and does not retrace its steps
  - A closed tour is one which returns to the starting location
  - An open tour does not have this restriction
- The travelling salesman problem is to find a closed tour of a set of towns with minimal total path length
- In graph theory, a tour of edges is referred to as an Eulerian tour.
- In graph theory, a closed tour is referred to as a Hamiltonian circuit

Prince's tour

- Consider a special chess piece—to be called here a "prince"
- Prince can move one square to the right, or one square downward, or one square diagonally upward to the left.
- Find all values of n for which a prince can visit all the squares of an $n \times n$ board exactly once on the same tour.

Knight's Tour

- A chess knight moves to a square that is two squares away horizontally and one square vertically, or two squares vertically and one square horizontally.

- Is It possible for a chess knight to visit all the cells of an 8x8 chessboard exactly once, ending at a cell one knight's move away from the starting cell? (see figure in next slide)

- For example, the knight starts at square 1 and ends at square 64.
- We can assume this since the board is symmetric.

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King's Tour

- A King can move one square in any direction
- Can we construct a closed king's tour of a standard 8x8 chessboard?
    - If so, find it.
    - If not, prove it.
- What is the largest square board for which we can construct a king's tour?

Bishop's Tour

- A Bishop can only move diagonally, on its own colour
- Assuming the bishop's tour only requires visiting all squares of the same colour…
- can we construct a closed bishop's tour of a standard 8x8 chessboard?
  - If so, find it.
  - If not, prove it.
- What is the largest square board for which we can construct a bishop's tour?