**MATH 6**
HANDOUT 20: COLORING AND CUTTING

HOMEWORK

1. In each square of a 2011×2011 board there is a bug. At some moment each bug jumps into one of the adjacent squares. Explain why after that one of the squares will be empty. [Hint: how many bugs there were on black squares? on white squares?]

2. Can one color a quad ruled paper using 3 colors so that each 1×3 rectangle contains squares of each of 3 colors?

3. Kathryn had a construction kit which has 12 1×3 wooden tiles. Another student from our class has stolen one of the tiles and replaced it with an L-shaped one. Can Kathryn make a 6×6 square using these tiles?
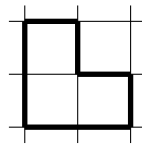
4. Can you cut an 8×8 board into 15 horizontal and 17 vertical 1×2 tiles?

5. You have a $3 \times 3 \times 3$ cube with the central $1 \times 1 \times 1$ small cube removed. Is it possible to cut it into $1 \times 1 \times 2$ pieces?

6. A piece of cheese has the shape of a $3 \times 3 \times 3$ cube with the central $1 \times 1 \times 1$ small cube removed. A mouse starts eating the cheese eating one $1 \times 1 \times 1$ cube at a time and then moving to a next one (so that the next one has a common face with the one it had just eaten). Can the mouse eat all the cheese?

7. In a computer game, a wizard is more powerful than an orc, so when a wizard fights an orc, he has 60% chance of winning. If a wizard fights one by one a group of 5 orcs, what are the chances that he will defeat them all?

8. In how many ways can one arrange 5 books on a shelf?

*9. In how many ways can you arrange 5 books on 2 shelves? Order on each shelf matters.