Instructions. Write all answers clearly on one piece of paper, and put all group members’ names on the top of the paper. If you talk, you must do so very quietly!

1. Write down a group of the form \( U(s) \oplus U(t) \) that is isomorphic to \( U(105) \).

2. Add \((1, 1, 0, 0, 1, 1, 1)\) and \((1, 0, 0, 1, 0, 0, 1)\) in \( \mathbb{Z}_2 \oplus \mathbb{Z}_2 \oplus \mathbb{Z}_2 \oplus \mathbb{Z}_2 \oplus \mathbb{Z}_2 \oplus \mathbb{Z}_2 \oplus \mathbb{Z}_2 \).

3. What computationally intractable problem does RSA rely on for transmitting information secretly?

4. A DNA strand TACGA is denoted in \( \mathbb{Z}_5^4 \) by 20310. Its complementary strand is ATGCT, denoted by 02132. What operation in \( \mathbb{Z}_5^4 \) sends a DNA strand to its complement?

5. A single light is controlled by 3 different switches. Flipping any switch changes the light between on and off regardless of the positions of the other switches and the state of the light. Suppose the light is on when all the switches but the 3rd are in the “up” position, represented by \((1, 1, 0)\). Give the coset representation in \( \mathbb{Z}_2^3 \) for the switch positions for which the light is on.