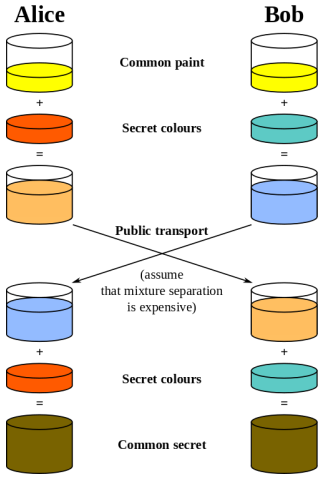
Introduction to Modern Cryptography, Exercise # 8

University of Amsterdam, Master of Logic
Lecturer: Christian Schaffner
TA: Joachim Schipper

1 November 2011
(to be handed in by Tuesday, 8 November 2011, 9:00)

1. **Square-And-Multiply, Efficient Modular Exponentiation:** Exercise B.3 in [KL]. Argue why your algorithm is efficient. **Corrected hint:** Let $y = [a^b \mod N]$ denote the answer. Use auxiliary variables x (initialized to a) and t (initialized to 1), and maintain the invariant $t \cdot x^b = y \mod N$ while decreasing b and squaring x. The algorithm terminates when $b = 0$ and t is equal to the answer.
2. **Interactive Secure Encryption:** Exercise 9.1 in [KL]
3. **Man-In-The-Middle Attacks:** Exercise 9.2 in [KL]
4. **Key Exchange with Bit Strings:** Exercise 9.3 in [KL]
5. **CDH and DDH:**
   (a) Give an example of a (not necessarily multiplicative) group $\mathcal{G}$ relative to which the CDH-Problem is easy.
   (b) Prove formally that the hardness of the CDH problem relative to a group $\mathcal{G}$ implies the hardness of the discrete logarithm problem relative to $\mathcal{G}$. (Exercise 7.15 in [KL])
   (c) Prove formally that the hardness of the DDH problem relative to a group $\mathcal{G}$ implies the hardness of the CDH problem relative go $\mathcal{G}$. (Exercise 7.16 in [KL])



Diffie-Hellman Key Exchange Using Buckets of Paint
Image credit: `wikimedia.org`.