Introduction to Modern Cryptography
Exercise Sheet #6

University of Amsterdam, Master of Logic, 2012
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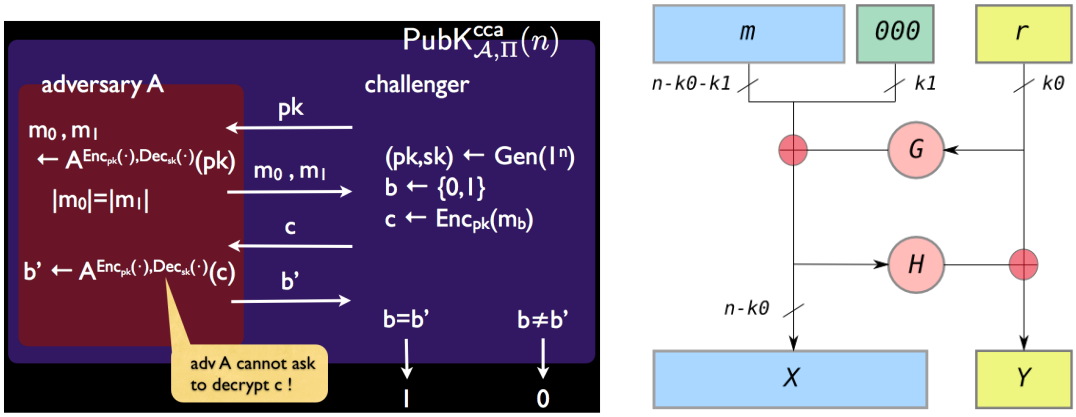
(to be handed in by Wednesday, 19 December 2012, 13:00)

1. **RSA-Padding and CCA-Security:** Exercise 10.14 in [KL]. **Hint:** Use messages m_0, m_1 whose ciphertexts you can transform into different valid ciphertexts if the most significant bit of the random part r of the padding is 0.



left: The $\mathsf{PubK}^{\mathsf{cca}}_{\mathcal{A},\Pi}(n)$ experiment, right: Optimal Asymmetric Encryption Padding (OAEP)
Image credit: `wikimedia.org`.

2. **El Gamal Variant:** Exercise 10.11 in [KL].

3. **Secure Coin-Flipping:** Exercise 10.17 in [KL].

4. **Paillier Encryption:**

   (a) Exercise 11.16 in [KL].

   (b) Exercise 11.15 in [KL].

   (c) Show that the hardness of the decisional residuosity problem with respect to GenModulus (as in Definition 11.31) implies the hardness of factoring with respect to GenModulus (as in Definition 7.45). **Hint:** use (b).

5. **(In-)Security of Textbook RSA Signatures for Weaker Security Notions:** Exercise 12.2 in [KL].

6. **Encoded RSA:** Exercise 12.4 in [KL].

7. **Public-Key Infrastructures:** Exercise 12.13 in [KL]

8. **Secure E-mail in Practice:** (This is a *bonus* exercise!) Send and receive PGP-encrypted e-mail. Start from `http://www.gnupg.org/` (GnuPG, includes links to Windows/Mac OS), look at `http://enigmail.mozdev.org/documentation/quickstart.php.html` (Thunderbird), or use whatever software makes sense for you.

   (a) There are several files in `http://homepages.cwi.nl/~schaffne/course/pgp/`. What can you tell us about these files?

   (b) Send an e-mail, encrypted and signed by your personal key, to both Maria and Christian. Ideally, your public key should be on the public keyservers; if you don't want to upload it, please send it to us (in the same or a separate message).