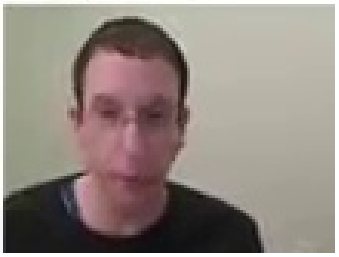
Stream ciphers

Stream ciphers are semantically secure



Goal: secure PRG ⇒ semantically secure stream cipher

Stream ciphers are semantically secure

Thm: $G: K \longrightarrow \{0,1\}^n$ is a secure PRG $\Rightarrow$

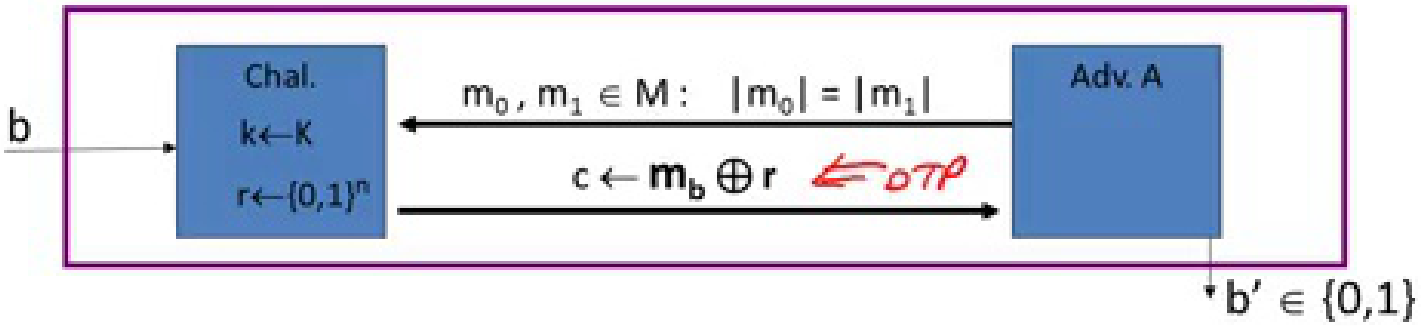
stream cipher E derived from G is sem. sec.

$\forall$ sem. sec. adversary A, $\exists$ a PRG adversary B s.t.

$$Adv_{SS}[A,E] \leq 2 \cdot Adv_{PRG}[B,G]$$

neg. neg.

Proof: Let A be a sem. sec. adversary.



For b=0,1: W_b := [event that b'=1].

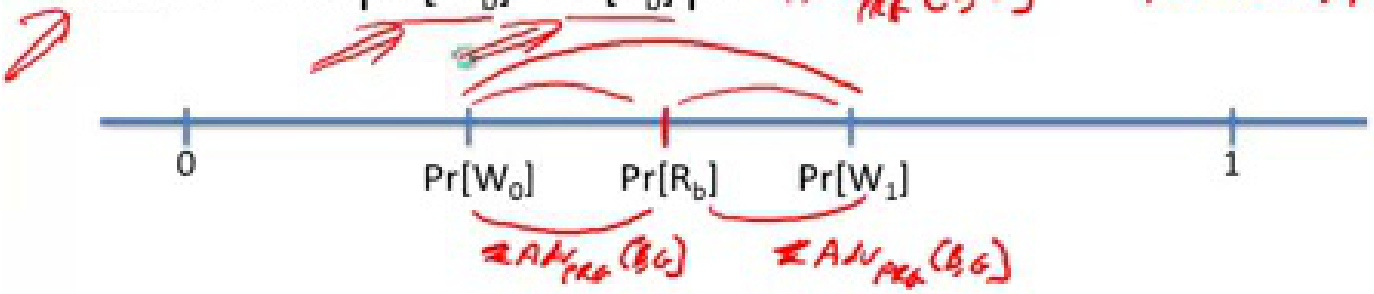
$$Adv_{SS}[A,E] = \left| Pr[W_0] - Pr[W_1] \right|$$

For b=0,1: R_b := [event that b'=1]

Proof: Let A be a sem. sec. adversary.

Claim 1: $\left|\Pr[R_0] - \Pr[R_1]\right| = Adv_{SS}(A, OTP) = 0$

Claim 2: $\exists B: \left|\Pr[W_b] - \Pr[R_b]\right| = Adv_{PRG}(B, G)$ for $b = 0, 1$



$\Rightarrow \quad Adv_{SS}[A,E] = \left|\Pr[W_0] - \Pr[W_1]\right| \leq 2 \cdot Adv_{PRG}[B,G]$

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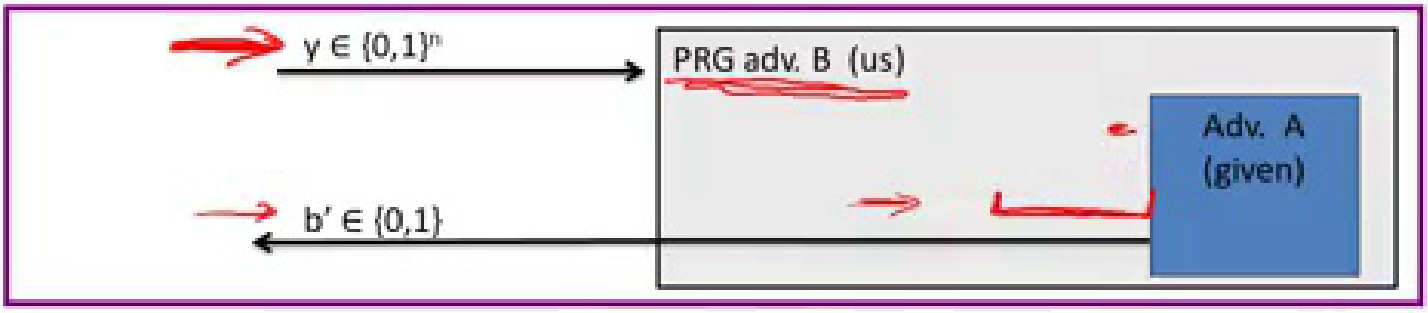
Proof of claim 2: $\exists B: \left|\Pr[W_0] - \Pr[R_0]\right| = \mathrm{Adv}_{PRG}[B,G]$

Algorithm B:



$$\left|\Pr_{k\in\{0,1\}^n}[B(G(k))=1] - \Pr_{r\in\{0,1\}^{2k}}[B(r)=1]\right| = \left|\Pr[R_0] - \Pr[W_0]\right|$$

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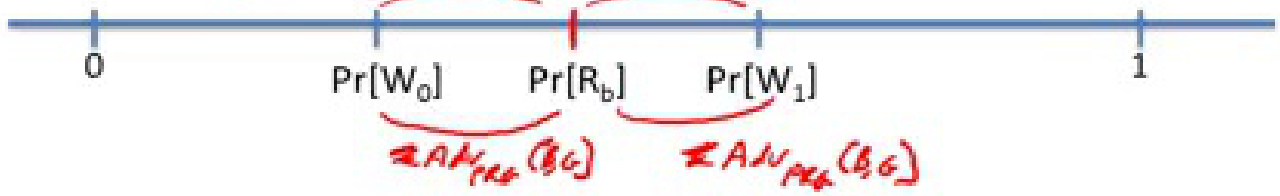
Proof: Let A be a sem. sec. adversary.

Claim 1: $\left|\Pr[R_0] - \Pr[R_1]\right| = Adv_{SS}(A, OTP) = 0$

Claim 2: $\exists B: \left|\Pr[W_b] - \Pr[R_b]\right| = Adv_{PRG}(B, G)$ for $b = 0, 1$



$\Rightarrow \quad Adv_{SS}[A,E] = \left|\Pr[W_0] - \Pr[W_1]\right| \leq 2 \cdot Adv_{PRG}[B,G]$

End of Segment