Lecture 8.2: Pseudorandom Function Construction

Lecture 8.2: Pseudorandom Function Construction

[Goldreich-Goldwasser-Micali-84] Construction

• Let
$$G: \{0,1\}^n \to \{0,1\}^{2n}$$
 be a PRG

Lecture 8.2: Pseudorandom Function Construction

・ロト ・ 御 ト ・ 注 ト ・ 注 ト

[Goldreich-Goldwasser-Micali-84] Construction

• Let
$$G \colon \{0,1\}^n o \{0,1\}^{2n}$$
 be a PRG

• WLOG
$$G(s) = (G_0(s), G_1(s))$$
, where $G_0, G_1 : \{0, 1\}^n \to \{0, 1\}^n$

・ロト ・ 御 ト ・ 注 ト ・ 注 ト

• Let
$$G \colon \{0,1\}^n \to \{0,1\}^{2n}$$
 be a PRG

• WLOG
$$G(s) = (G_0(s), G_1(s))$$
, where $G_0, G_1 : \{0, 1\}^n \to \{0, 1\}^n$

•
$$f_s(x) := G_{x_n}(G_{x_{n-1}}(\cdots G_{x_1}(s)\cdots))$$

・ロト ・ 御 ト ・ 注 ト ・ 注 ト

• Let
$$G \colon \{0,1\}^n o \{0,1\}^{2n}$$
 be a PRG

• WLOG
$$G(s) = (G_0(s), G_1(s))$$
, where $G_0, G_1 : \{0, 1\}^n \to \{0, 1\}^n$

•
$$f_s(x) := G_{x_n}(G_{x_{n-1}}(\cdots G_{x_1}(s)\cdots))$$

Proof: Next Lecture

・ロッ ・雪 ・ ・ ヨ ・ ・ ヨ ・

• Let ℓ and p be prime numbers such that $\ell|(p-1)$



- Let ℓ and p be prime numbers such that $\ell|(p-1)$
- Let $g \in \mathbb{F}_p^*$ be a generator of order ℓ

イロト イポト イヨト イヨト

- Let ℓ and p be prime numbers such that $\ell|(p-1)$
- Let $g \in \mathbb{F}_p^*$ be a generator of order ℓ

•
$$f_s(x) := g^{s_1^{x_1} \dots s_n^{x_n}}$$
, for $(s_1, \dots, s_n) \in \mathbb{F}_\ell^n$

イロト イポト イヨト イヨト

- Let ℓ and p be prime numbers such that $\ell|(p-1)$
- Let $g \in \mathbb{F}_p^*$ be a generator of order ℓ

•
$$f_s(x) := g^{s_1^{x_1} \dots s_n^{x_n}}$$
, for $(s_1, \dots, s_n) \in \mathbb{F}_\ell^n$

• Proof: Read on your own

イロト イポト イヨト イヨト

• Constrained PRFs [Boneh-Waters-13]

・ロト ・四ト ・ヨト ・ヨト Lecture 8.2: Pseudorandom Function Construction

- Constrained PRFs [Boneh-Waters-13]
- PRFs with "Punctured Keys" [Sahai-Waters-14]



- Constrained PRFs [Boneh-Waters-13]
- PRFs with "Punctured Keys" [Sahai-Waters-14]
- Should evaluation of $f_s(x)$ help predict $f_{s'}(x')$?

- Constrained PRFs [Boneh-Waters-13]
- PRFs with "Punctured Keys" [Sahai-Waters-14]
- Should evaluation of $f_s(x)$ help predict $f_{s'}(x')$?
- Can PRFs be computed by shallow circuits? [Linial-Mansour-Nisan-94]