

## **Exercise Sheet 6**

### **Density Transformations and ICA**

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# **Problem 6.2**

## **Random Number Generation**

## Problem 6.2 Random Number Generation

Formulas:

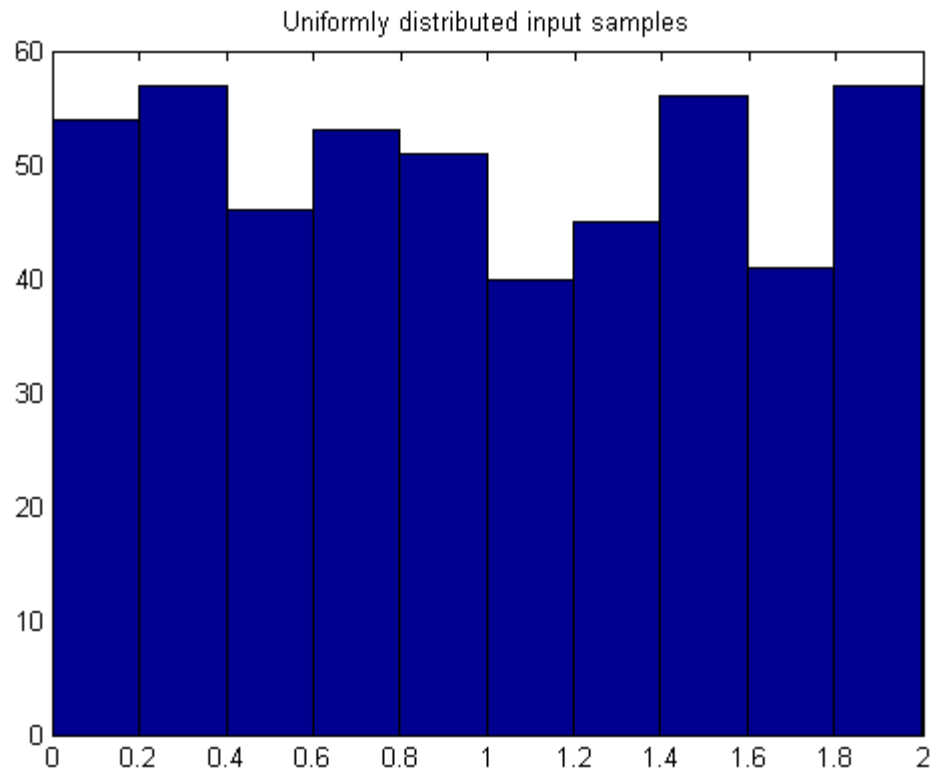
$$p(x) = \frac{1}{2b} \exp \left( -\frac{|x - \mu|}{b} \right)$$

$$F_x(x) = \begin{cases} \frac{1}{2} \exp \left( \frac{x - \mu}{b} \right), & x \leq \mu \\ 1 - \frac{1}{2} \exp \left( -\frac{x - \mu}{b} \right), & x > \mu \end{cases}$$

$$F_x^{-1}(y) = \begin{cases} \mu + b \cdot \ln(|2y|), & y \leq \mu \\ \mu - b \cdot \ln(|2(1 - y)|), & y > \mu \end{cases}$$

## Problem 6.2 Random Number Generation

500 Uniformly distributed input samples:



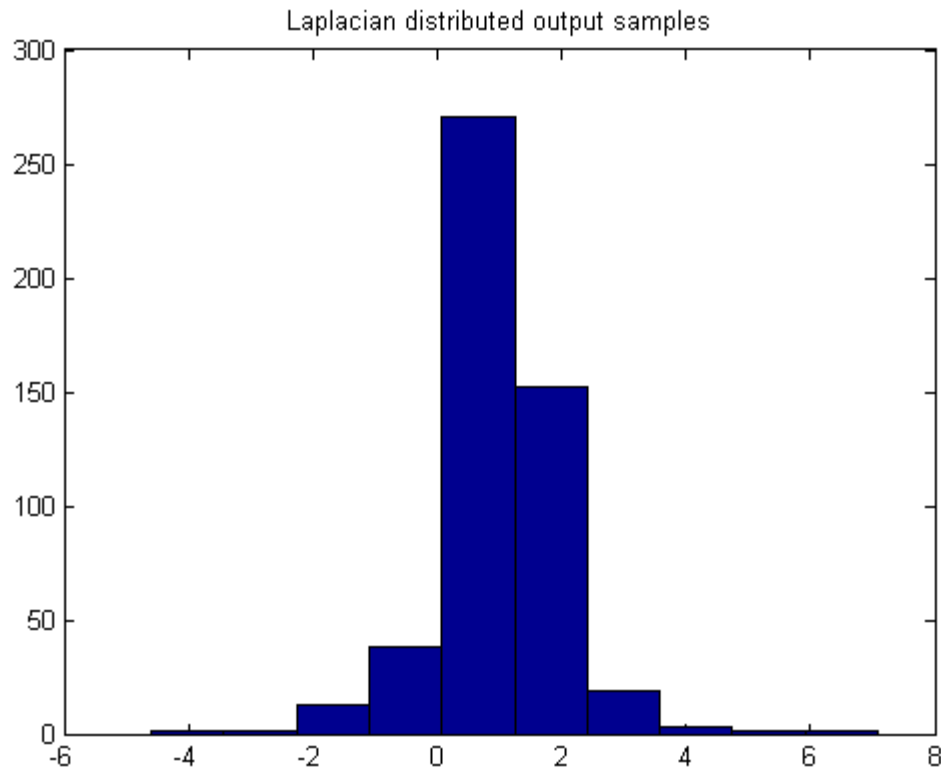
## Problem 6.2 Random Number Generation

500 Laplacian distributed output samples:

mean = 1

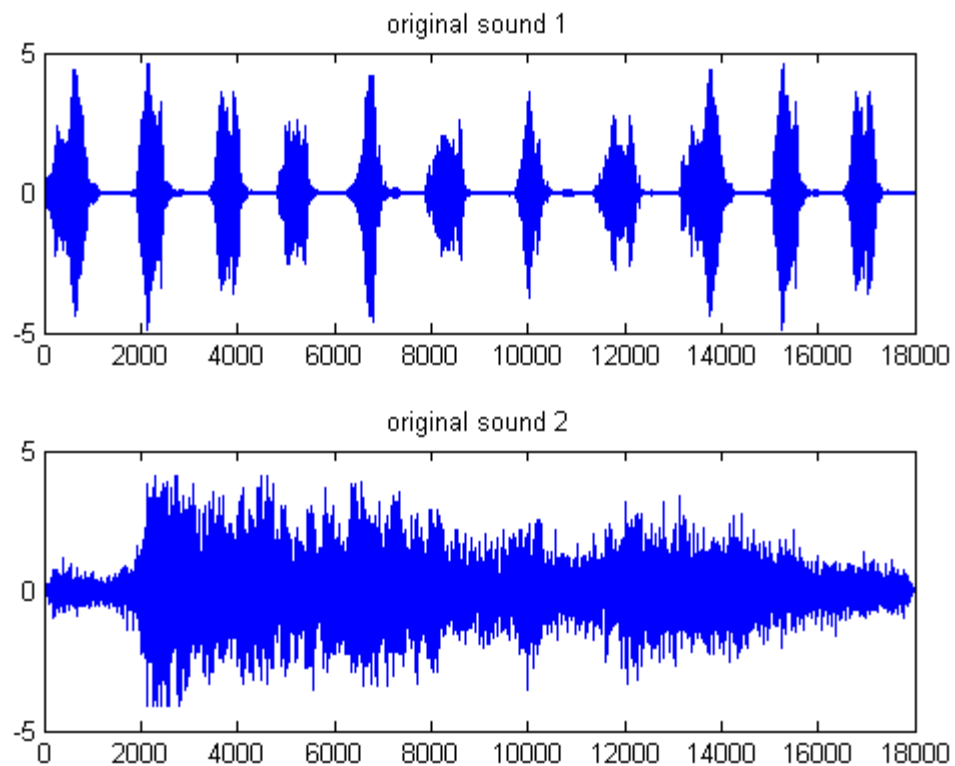
variance = 2

=> **b=1**



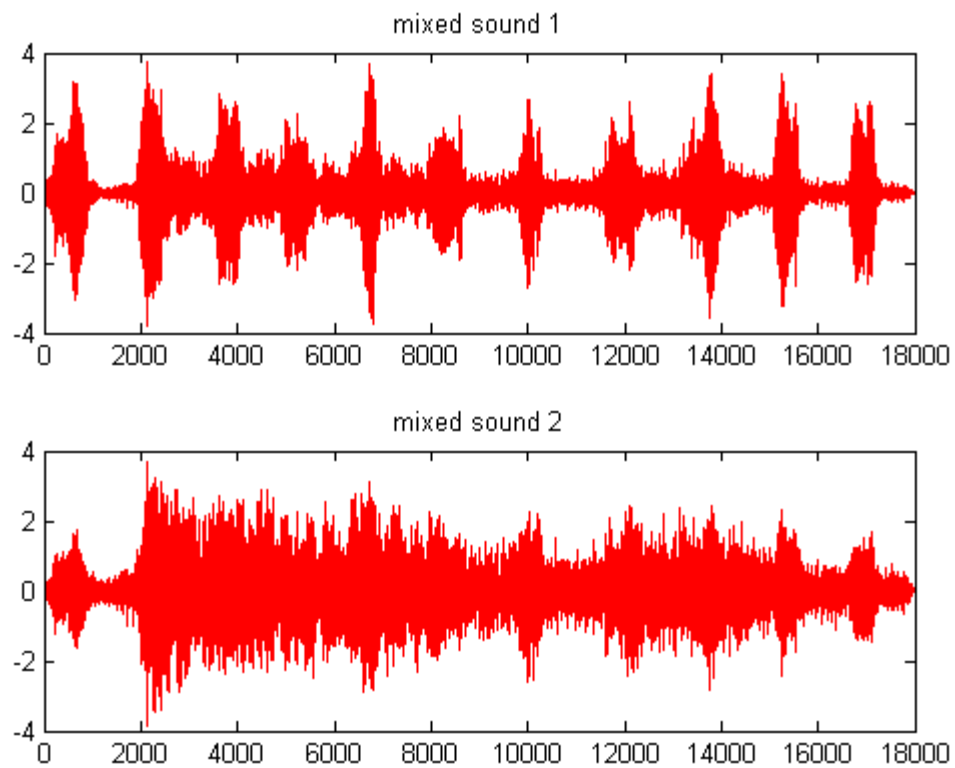
## Problem 6.3 ICA

Original sounds:



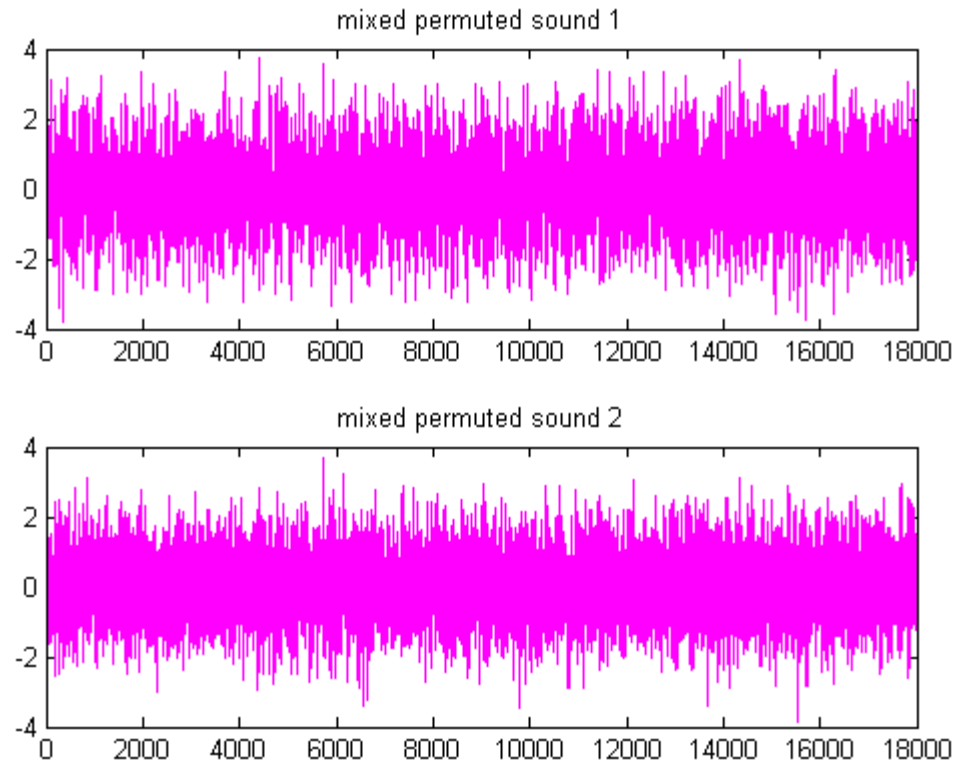
## Problem 6.3 ICA

Mixed sounds:



## Problem 6.3 ICA

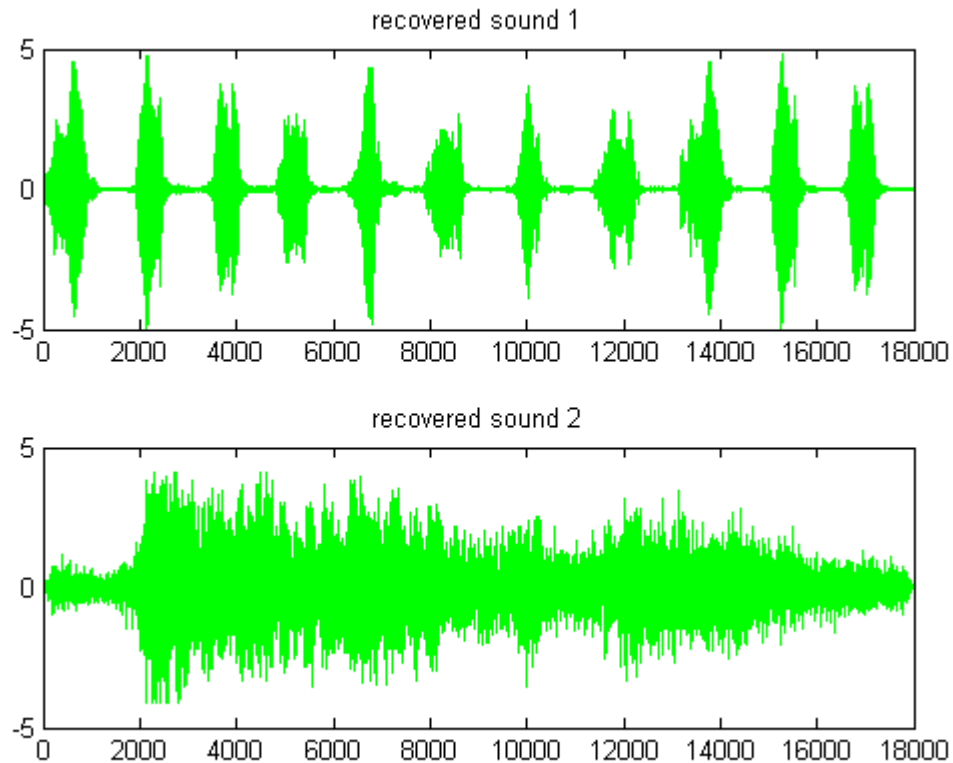
### Mixed permuted sounds:





## Problem 6.3 ICA

### Recovered sounds:



### Correlations:

$$\rho_{s,x} = \begin{pmatrix} 1 & 0.0018 \\ 0.0018 & 1 \end{pmatrix}$$

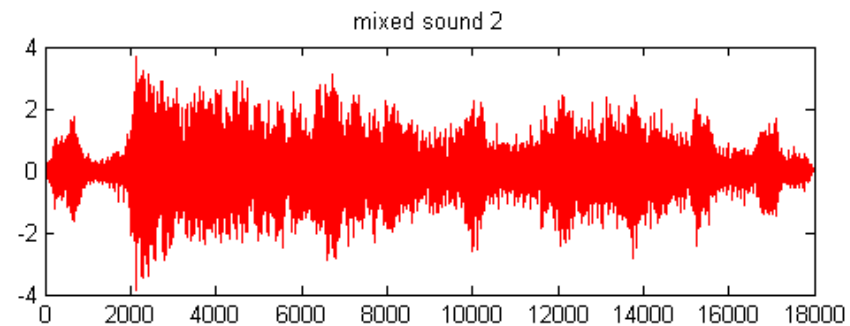
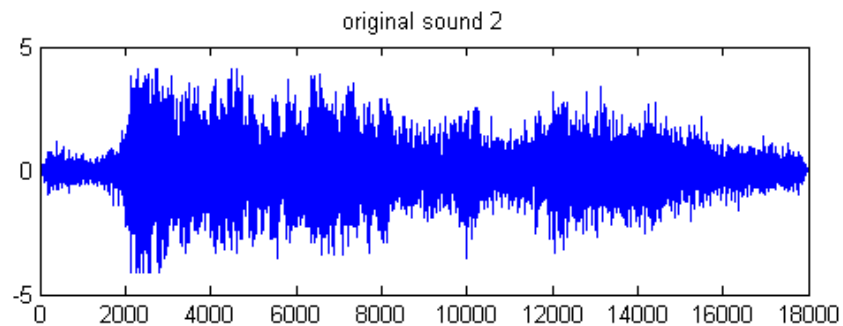
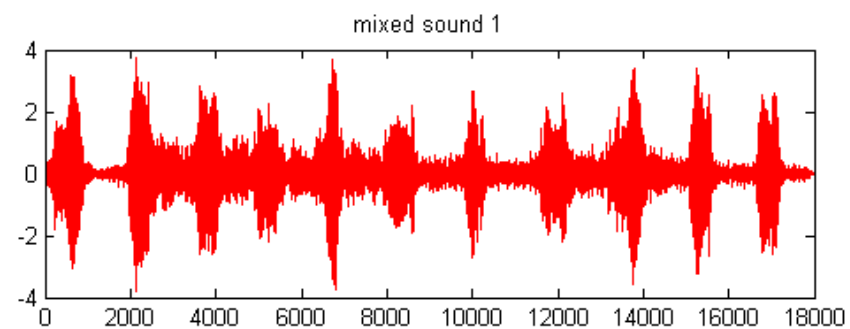
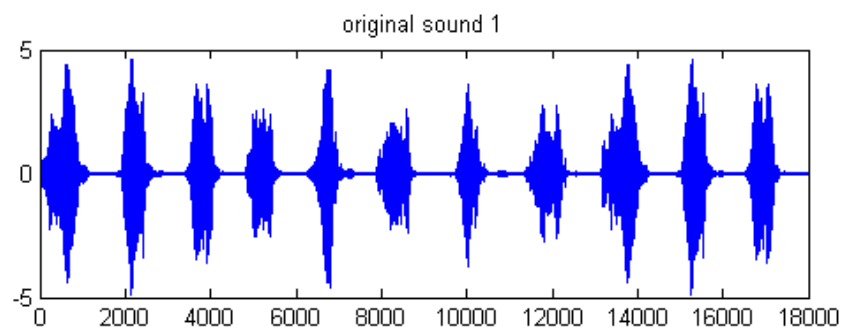
$$\rho_{s,\hat{s}} = \begin{pmatrix} 1 & 0.9997 \\ 0.9997 & 1 \end{pmatrix}$$

### Learning rate:

$$\eta = 0.02$$

# Problem 6.3 ICA

## Comparison



# Problem 6.3 ICA

## Comparison

