



UNIUNEA EUROPEANĂ



GUVERNUL ROMÂNIEI



Instrumente Structurale  
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# Platformă de e-learning și curriculum e-content pentru învățământul superior tehnic

## Transmisia datelor multimedia in rețele de calculatoare

**17. LZ78**

# LZ78

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- LZ77 presupune localitatea grupurilor de simboluri
- LZ78:
  - Nu exista un buffer de cautare – dictionarul este explicit
  - Codificatorul/decodificatorul construiesc dictionarul intr-un mod sincronizat
  - Codificare:  $\langle i, c \rangle$ 
    - $i$  = indexul din dictionar
    - $c$  = codul urmatorului simbol
- Example:
  - wabba□wabba□wabba□wabba□woo□woo□woo

# Exemplu LZ78

Input: wabba□wabba□wabba□wabba□woo□woo□woo

Dictionar:

Output:

Index	Intr.

# Exemplu LZ78

Input: wabba□wabba□wabba□wabba□woo□woo□woo

Dictionar:

Index	Intr.
<u>1</u>	<u>w</u>

Output:

<0, C(w)>

# Exemplu LZ78

Input: -abbawabbawabbawabba $\square$ woowoo $\square$ woo

Dictionar:

Index	Intr.
1	w
<u>2</u>	<u>a</u>

Output:

$\langle 0, C(w) \rangle$

$\langle 0, C(a) \rangle$

# Exemplu LZ78

Input: --bba□wabba□wabba□wabba□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	<u>b</u>

Output:

<0, C(w)>

<0, C(a)>

**<0, C(b)>**

# Exemplu LZ78

Input: ---ba wabba wabba wabba woo woo woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	<u>ba</u>

Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

**<3, C(a)>**

# Exemplu LZ78

Input: -----wabba□wabba□wabba□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	<u>□</u>

Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

<3, C(a)>

**<0, C(□)>**



# Exemplu LZ78

Input: -----wabba □ wabba □ wabba □ woo □ woo □ woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
<u>6</u>	<u>wa</u>

Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

<3, C(a)>

<0, C(□)>

**<1, C(a)>**

# Exemplu LZ78

Input: -----bb□wabba□wabba□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	<u>bb</u>

Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

<3, C(a)>

<0, C(□)>

<1, C(a)>

**<3, C(b)>**

# Exemplu LZ78

Input: -----a□wabba□wabba□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
<u>8</u>	<u>a</u> □

Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

<3, C(a)>

<0, C(□)>

<1, C(a)>

<3, C(b)>

**<2, C(□)>**

# Exemplu LZ78

Input: -----wabba□wabba□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	<u>wab</u>

Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

<3, C(a)>

<0, C(□)>

<1, C(a)>

<3, C(b)>

<2, C(□)>

**<6, C(b)>**

# Exemplu LZ78

Input: -----ba□wabba□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
<u>10</u>	<u>ba</u> □

Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

<3, C(a)>

<0, C(□)>

<1, C(a)>

<3, C(b)>

<2, C(□)>

<6, C(b)>

<4, C(□)>

# Exemplu LZ78

Input: -----wabb□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
10	ba□

<u>11</u>	<u>wabb</u>
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Output:

<0, C(w)>

<0, C(a)>

<0, C(b)>

<3, C(a)>

<0, C(□)>

<1, C(a)>

<3, C(b)>

<2, C(□)>

<6, C(b)>

<4, C(□)>

**<9, C(b)>**

# Exemplu LZ78

Input: -----a□woo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
10	ba□

11	wabb
<u>12</u>	<u>a□w</u>

Output:

<0, C(w)>  
 <0, C(a)>  
 <0, C(b)>  
 <3, C(a)>  
 <0, C(□)>  
 <1, C(a)>  
 <3, C(b)>  
 <2, C(□)>  
 <6, C(b)>  
 <4, C(□)>  
 <9, C(b)>  
<8, C(w)>

# Exemplu LZ78

Input: -----oo□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
10	ba□

11	wabb
12	a□w
<u>13</u>	<u>o</u>

Output:

<0, C(w)>  
 <0, C(a)>  
 <0, C(b)>  
 <3, C(a)>  
 <0, C(□)>  
 <1, C(a)>  
 <3, C(b)>  
 <2, C(□)>  
 <6, C(b)>  
 <4, C(□)>  
 <9, C(b)>  
 <8, C(w)>  
<0, C(o)>



# Exemplu LZ78

Input: -----o□woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
10	ba□

11	wabb
12	a□w
13	o
<u>14</u>	<u>o</u> □

Output:

<0, C(w)>  
 <0, C(a)>  
 <0, C(b)>  
 <3, C(a)>  
 <0, C(□)>  
 <1, C(a)>  
 <3, C(b)>  
 <2, C(□)>  
 <6, C(b)>  
 <4, C(□)>  
 <9, C(b)>  
 <8, C(w)>  
 <0, C(o)>  
**<13, C(□)>**

# Exemplu LZ78

Input: -----woo□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
10	ba□

11	wabb
12	a□w
13	o
14	o□
<u>15</u>	<u>wo</u>

Output:

<0, C(w)>  
 <0, C(a)>  
 <0, C(b)>  
 <3, C(a)>  
 <0, C(□)>  
 <1, C(a)>  
 <3, C(b)>  
 <2, C(□)>  
 <6, C(b)>  
 <4, C(□)>  
 <9, C(b)>  
 <8, C(w)>  
 <0, C(o)>  
 <13, C(□)>  
<1, C(o)>

# Exemplu LZ78

Input: -----o□woo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
10	ba□

11	wabb
12	a□w
13	o
14	o□
15	wo
<u>16</u>	<u>o□w</u>

Output:

<0, C(w)>  
 <0, C(a)>  
 <0, C(b)>  
 <3, C(a)>  
 <0, C(□)>  
 <1, C(a)>  
 <3, C(b)>  
 <2, C(□)>  
 <6, C(b)>  
 <4, C(□)>  
 <9, C(b)>  
 <8, C(w)>  
 <0, C(o)>  
 <13, C(□)>  
 <1, C(o)>  
<14, C(w)>

# Exemplu LZ78

Input: -----oo

Dictionar:

Index	Intr.
1	w
2	a
3	b
4	ba
5	□
6	wa
7	bb
8	a□
9	wab
10	ba□

11	wabb
12	a□w
13	o
14	o□
15	wo
16	o□w
<u>17</u>	<u>oo</u>

Output:

<0, C(w)>  
 <0, C(a)>  
 <0, C(b)>  
 <3, C(a)>  
 <0, C(□)>  
 <1, C(a)>  
 <3, C(b)>  
 <2, C(□)>  
 <6, C(b)>  
 <4, C(□)>  
 <9, C(b)>  
 <8, C(w)>  
 <0, C(o)>  
 <13, C(□)>  
 <1, C(o)>  
 <14, C(w)>  
**<13, C(o)>**

# LZ78

- Observatie
  - Daca continuam sa codificam, dictionarul continua sa creasca
- Solutii practice
  - Oprirea cresterii dictionarului
    - efectiv, considerarea dictionarului ca unul static
  - Micsorarea dictionarului
    - Ex. Pe baza statisticilor de utilizare
  - Resetarea dictionarului
  - Fara a cunoaste informatii specifice referitoare la sursa, tehnicile de mai sus nu garanteaza succesul